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THE INLAND ARCHITECT AND NEWS RECORD

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CONTENTS.

EDITORIAL:
A New Method of Sub-construction — A Standard Specification for Gas-fitters — Death of Walter Cope, Architect, of Philadelphia 1

HEATING ... 2
By C. E. Thomas.

THE EFFECT OF WIND PRESSURE ON STRUCTURES (*Concluded*) 3
By Robert M. Neilson.

REVISION OF THE UNIFORM CONTRACT ... 5

PHILADELPHIA T-SQUARE CLUB EXHIBITION ... 5

SUB-CONSTRUCTION AS APPLIED TO STEEL BUILDINGS AND SUBWAYS ... 6

OUR ILLUSTRATIONS ... 9

PAINTS IN ARCHITECTURE ... 9

MOSAICS ... 9

INDEX TO ADVERTISEMENTS ... IX

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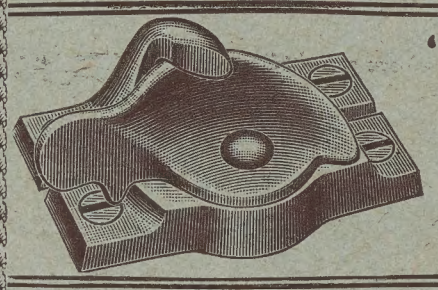

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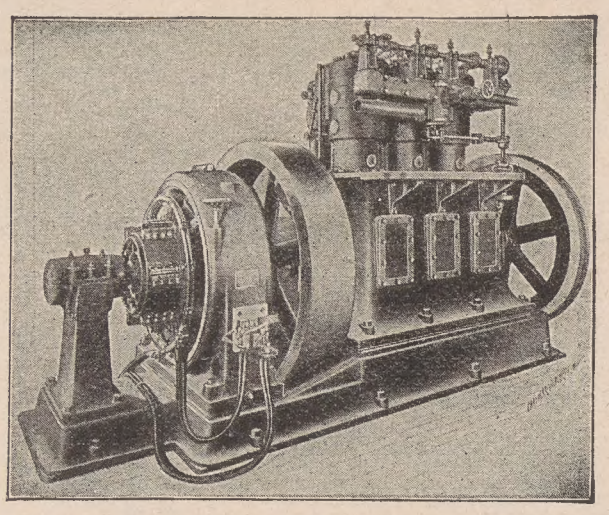

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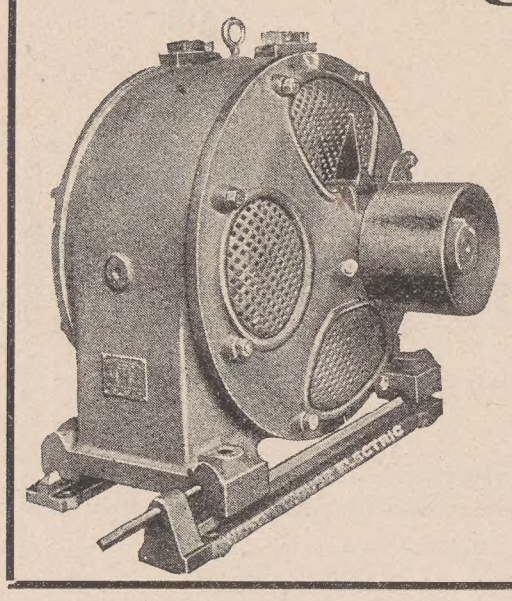

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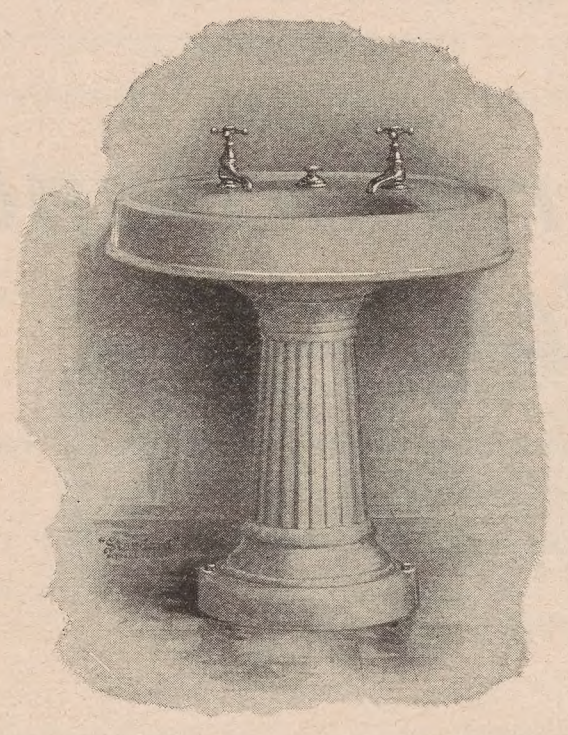

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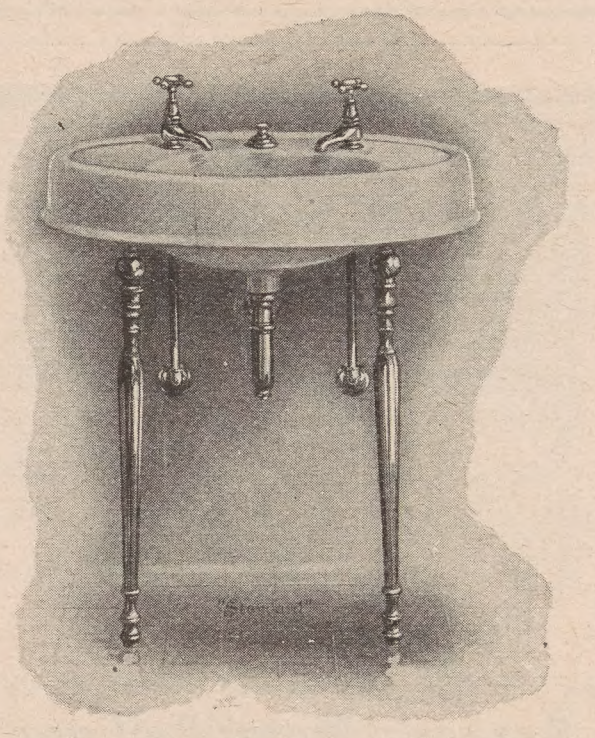

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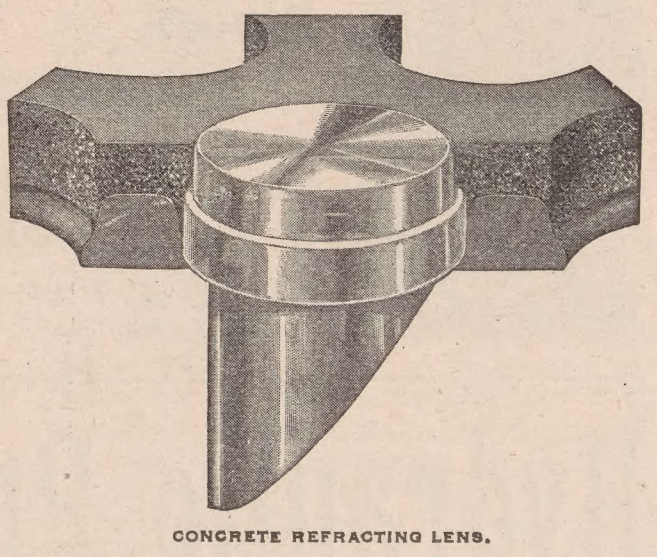

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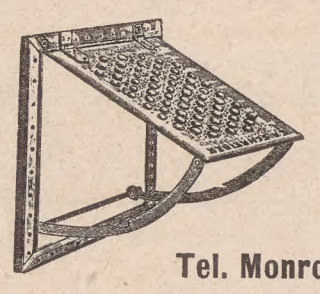

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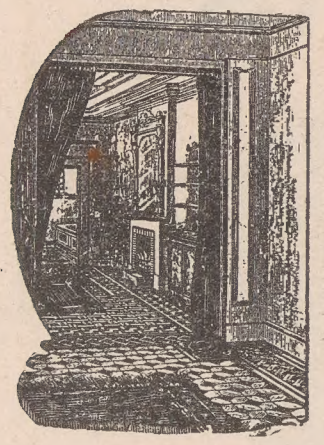

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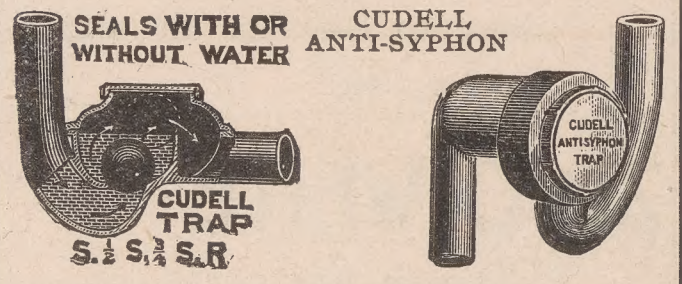

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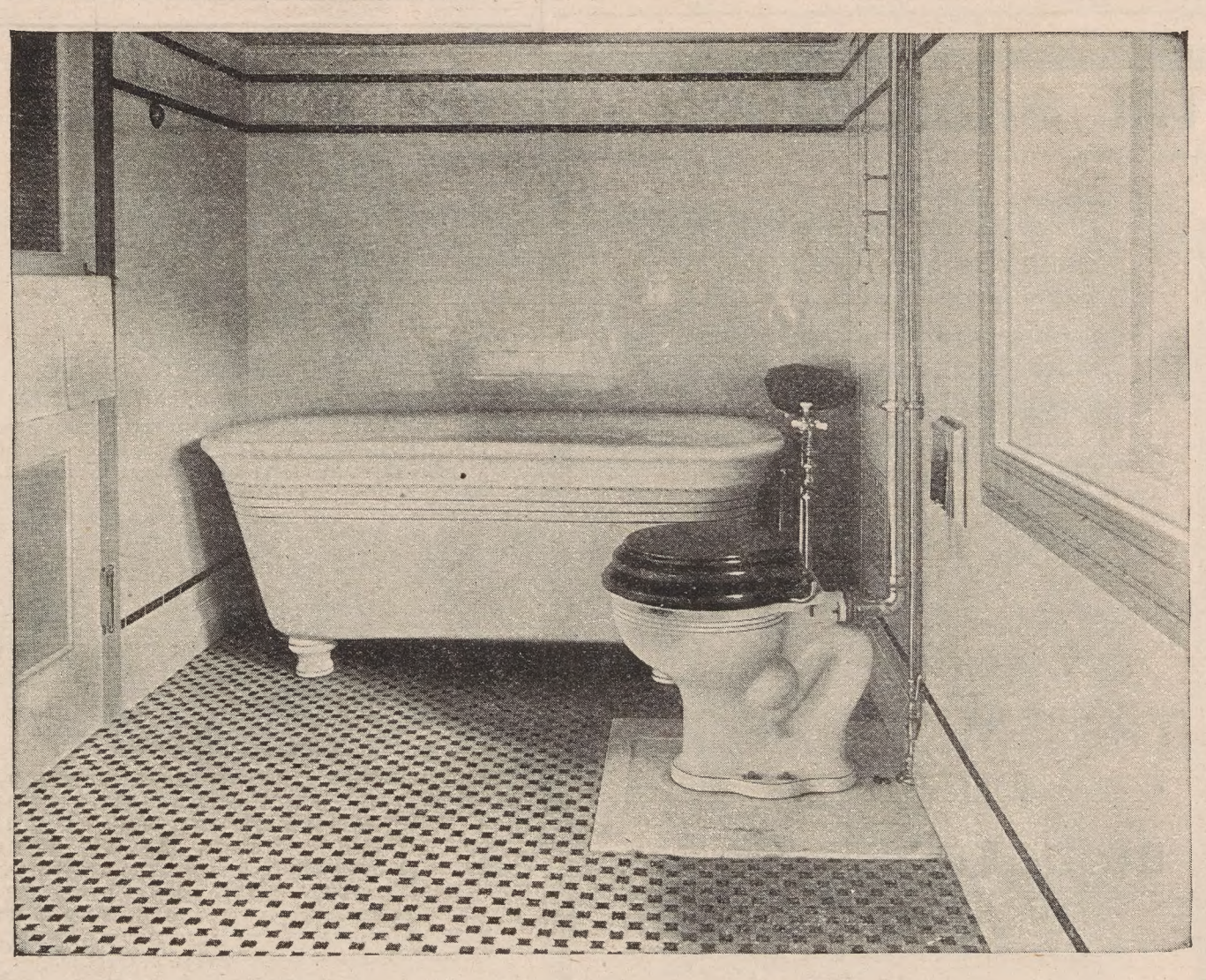

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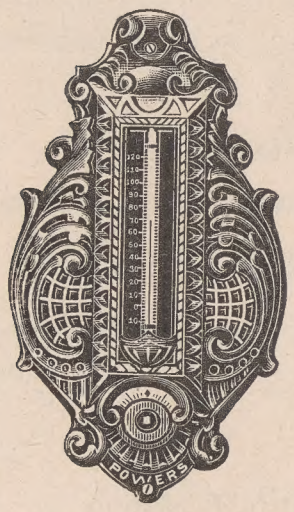

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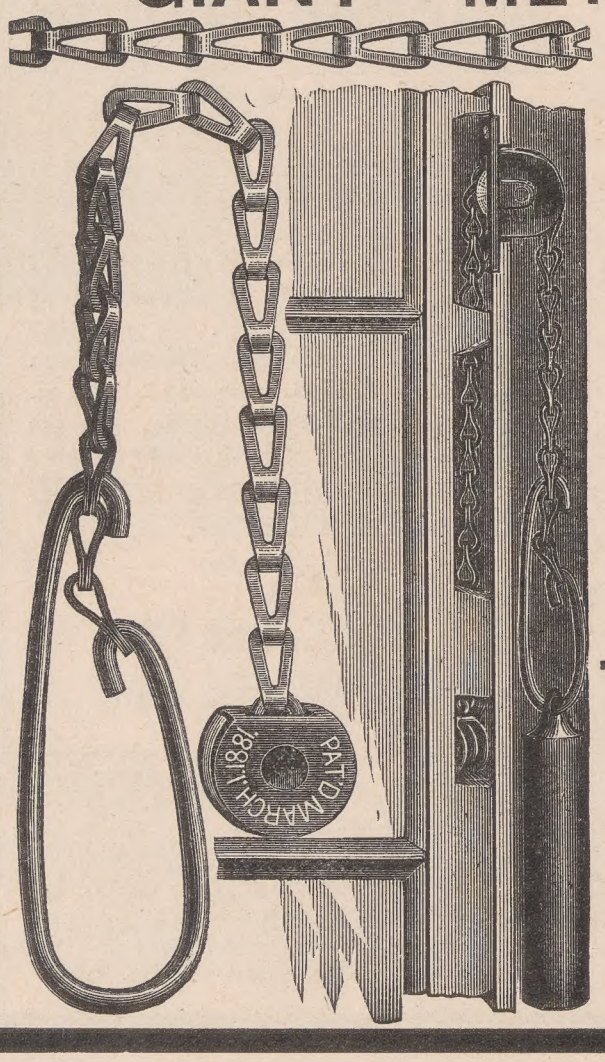

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INDEX TO ADVERTISEMENTS.

	Page
Architectural Drawing.	
Deane, E. Eldon	XV
Architectural Iron Works.	
The Winslow Bros. Co	II
American Sidewalk Light Co.	IX
Architectural Photographers.	
Taylor, J. W	XI
Architectural Views.	
Taylor, J. W	I
Boats.	
W. H. Mullins	X
Boiler Covering.	
The Keasbey & Mattison Co.	XII
Bricks (Pressed).	
Chicago Hydraulic Press Brick Co	IX
Findlay Hydraulic Press Brick Co	IX
Illinois Hydraulic Press Brick Co	IX
Kansas City Hydraulic Press Brick Co	IX
Menominee Hydraulic Press Brick Co	IX
Omaha Hydraulic Press Brick Co	IX
St. Louis Hydraulic Press Brick Co	IX
Brick (Enameled).	
Hydraulic Press Brick Co	IX
Brick (Ornamental).	
Chicago Hydraulic Press Brick Co	IX
Findlay Hydraulic Press Brick Co	IX
Hydraulic Press Brick Co	IX
Illinois Hydraulic Press Brick Co	IX
Kansas City Hydraulic Press Brick Co	IX
Menominee Hydraulic Press Brick Co	IX
Omaha Hydraulic Press Brick Co	IX
Builders' Hardware.	
Orr & Lockett	XVI
The Yale & Towne Mfg. Co.	XVI
Builders' Sundries.	
The Yale & Towne Mfg. Co.	XVI
Building Papers.	
Cabot, Samuel	XII
Cements.	
French, S. H., & Co	VI
Clothes Dryers.	
Cordage.	
Samson Cordage Works	XVI
Creosote Stains.	
Cabot, Samuel	XII
Decorators' Supplies.	
Drawing Material and Implements.	
Abbott, A. H., & Co	XII
Electric Plants.	
Westinghouse, Church, Kerr & Co	IV
The Westinghouse Machine Co	IV
Elevators.	
The J. W. Reedy Elevator Co	VII
Elevator Supplies.	
Elevator Supply & Repair Co.	V
Engineers.	
Westinghouse, Church, Kerr & Co	IV
The Westinghouse Machine Co	IV
Fireproof Doors.	
Kinnear Mfg. Co.	X
Fireproof Shutters.	
Kinnear Mfg. Co	VI
Fire Extinguisher.	
Yantacaw Mfg. Co	XII
Fireproofing.	
National Fireproofing Co	XIV
Pioneer Fireproofing Co	XIV
The Roebling Construction Co	XII
Floor Polish.	
Butcher Polish Co	XV
Gas Engines.	
Westinghouse, Church, Kerr & Co	IV
The Westinghouse Machine Co	IV
Grilles.	
Waddell Mfg. Co	X
Hardware.	
The Yale & Towne Mfg. Co.	XVI
Heating.	
Buffalo Forge Co	XIII
B. F. Sturtevant Co	III
Heating and Ventilating Apparatus.	
Buffalo Forge Co	XIII
Pierce, Butler & Pierce	XVI
B. F. Sturtevant Co	III
Kellogg-Mackay-Cameron Co.	XI
Ice and Refrigerating Machinery.	
Westinghouse, Church, Kerr & Co	IV
The Westinghouse Machine Co	IV
Instruction.	
American Correspondence School	XI
Interior Finish.	
Battle Creek Interior Finish Co	II
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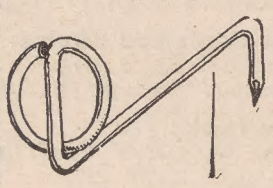

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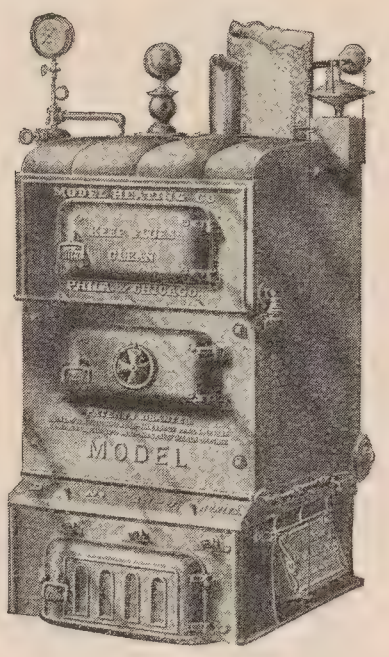

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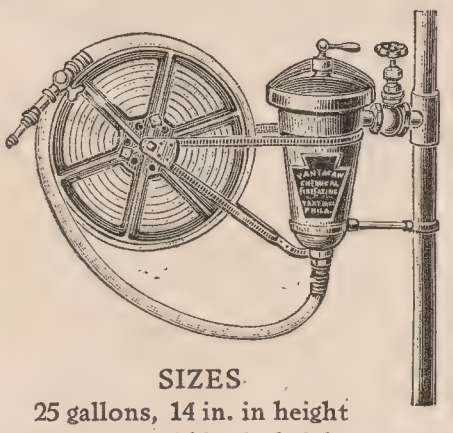

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THE INLAND ARCHITECT AND NEWS RECORD

Vol. XLI. FEBRUARY, 1903. No. 1

A Monthly Journal Devoted to

ARCHITECTURE,

CONSTRUCTION, DECORATION AND FURNISHING

IN THE WEST.

PUBLISHED BY THE INLAND PUBLISHING CO.,
609-610 MANHATTAN BUILDING, CHICAGO, ILL.

L. MULLER, Jr., Manager. ROBERT CRAIK McLEAN, Editor.

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TERMS: Regular number, $5 a year; Photogravure edition, $10 a year. Single copies, Regular number, 50c.; Photogravure edition (including 7 photogravures), $1. Advance payment required.

The columns and illustration pages of THE INLAND ARCHITECT are open to all alike, merit and availability only determining what shall be published. Contributions appropriate to its pages are always desired.

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A New Method of Sub-Construction.

In presenting in this issue Mr. John Meiggs Ewen's method of sub-construction, we do so with the belief that he has evolved a system that will greatly facilitate building, particularly in congested districts. Mr. Ewen is peculiarly fitted, as an engineer, for this work. He has been identified with the construction of most of the high buildings of Chicago, is a member of the Western Society of Engineers, the American Society of Mechanical Engineers, and for the past fifteen years has been an active member of the American Society for the Advancement of Science. His undoubted ability and large engineering experience will give to his new method of sub-construction a guarantee of perfect feasibility and economic superiority over all old methods.

A Standard Specification for Gasfiitters.

A standard specification for gasfitters has been prepared by the People's Gas Light and Coke Company, of Chicago, and is published in full in this issue for the guidance of architects in preparing specifications. Chicago is not the only city that has too frequently waited for private corporations to advance improved methods in building construction and maintenance, and these should at least receive ready acceptance when planned and offered for the betterment of building.

Death of Walter Cope, Architect, of Philadelphia.

Walter Cope, the surviving member of the firm of Cope & Stewardson, of Philadelphia, who died in that city on November 3, was an architect whose work showed a genius for combining picturesque exteriors with practical interior demands, and especially in college structures, and who, during his too short life, had become an important member of the large society of letters and art in Philadelphia. His work was at first with John Stewardson, under the style of Cope & Stewardson; some years ago the partner died, and his brother entered the firm, but Cope was the controlling mind, and the beautiful dormitory buildings of Pennsylvania University, the residence and other halls of Bryn Mawr College, and several buildings at Princeton University, arose to testify to his ability. At a special meeting of the Philadelphia Chapter of the American Institute of Architects the following resolutions were adopted:

Resolved, That in the overwhelming sadness which the sudden death of our friend and associate, Walter Cope, has cast about us, we still rejoice in the beauty of his life and his labors, which leave behind them so precious a memory and so stimulating an example. Deeply skilled in his art, there were brought to him from far and near problems of ever-increasing difficulty and importance. He bore joyously the burden of these many tasks, and stood before us steadfast in the discharge of duty, untiring in the pursuit of excellence and beauty, firm in upholding a noble standard of conduct. And yet it is not his work as an architect, distinguished as it is by volume and quality, that leaves with his companions the deepest impression of him, but rather his constant sincerity, his limpid truthfulness, his spontaneity and frankness, his joy in art, his splendid scorn of wrong.

Resolved, That in the death of Walter Cope, the architects of America have lost one of the ablest of their number, and that we his immediate associates mourn him, not alone as a fellow-artist, but as a friend tried in many ways and true in all.

There is a greatness in leaving artistic creations for the comfort and education of a people, but it is in the truth of such words as these that the most lasting monuments of human greatness are found.

HEATING.

BY C. E. THOMAS, ARCHITECT.

LOSS OF HEAT.

HEAT escapes from a building by passing through the walls and by being carried out by the air. If a building is heated throughout, it is obvious that the loss from any room must be due to the exposed surfaces only.

One square foot of glass gives off one British thermal unit per hour per degree of difference between the temperature of the room and that of the outside air. One square foot of wall gives off .25 B. T. U. per hour per degree of difference in temperature,

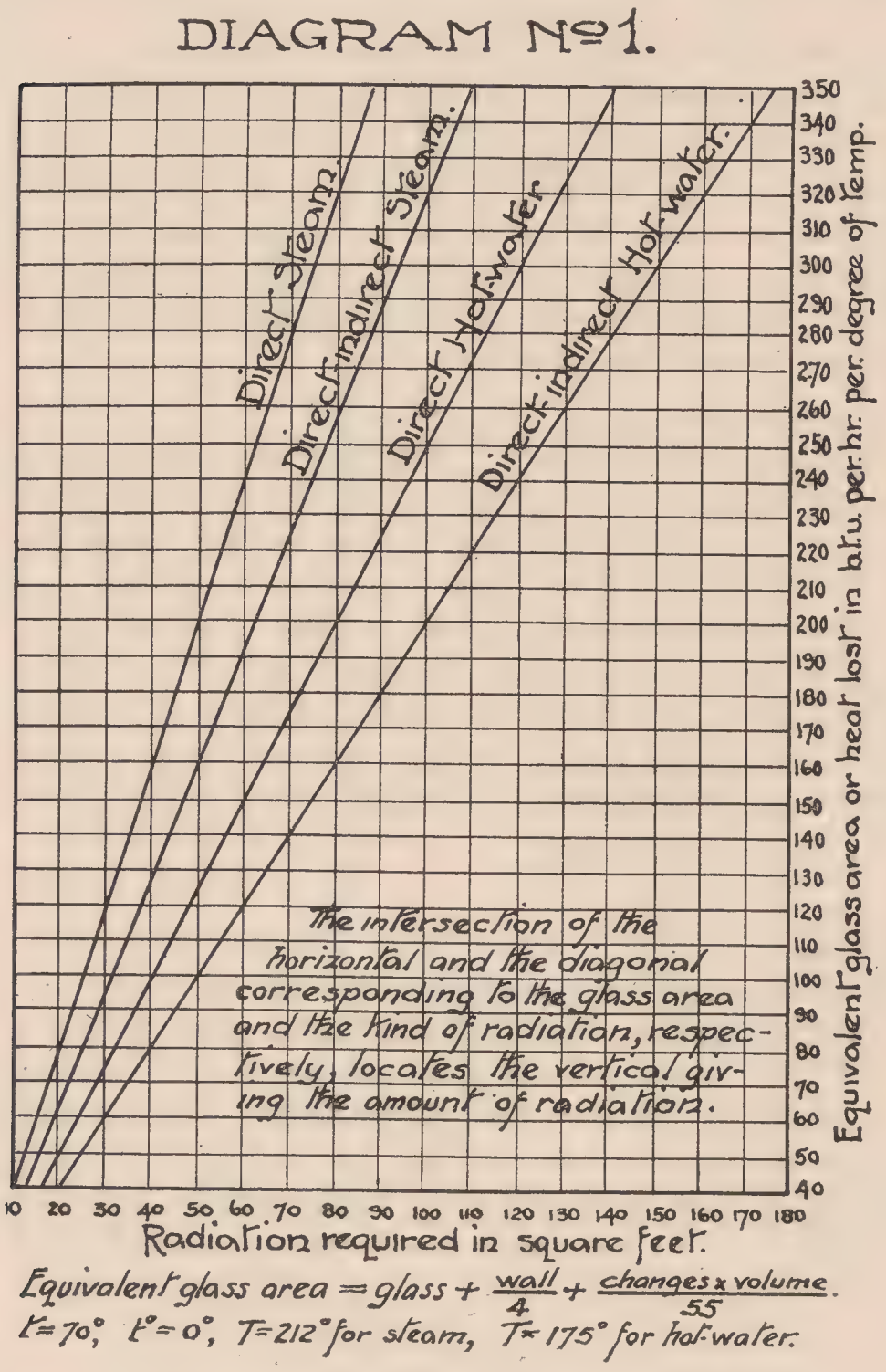
DIAGRAM No 1.
Direct Steam.
Direct-indirect Steam.
Direct Hot-water
Direct-indirect Hot-water.
The intersection of the horizontal and the diagonal corresponding to the glass area and the kind of radiation, respectively, locates the vertical giving the amount of radiation.
Equivalent glass area or heat lost in b.t.u. per hr. per degree of temp.
Radiation required in square feet.
Equivalent glass area = glass + wall/4 + changes x volume/55.
t=70°, t°=0°, T=212° for steam, T=175° for hot-water.
RADIATION REQUIRED.

hence if we add one-fourth of the wall area to the glass area and multiply the sum by the difference in temperature the result will be the loss in heat units per hour.

As the winds from the north and west are generally cold and severe it is usual to make the following allowances: Add for north exposure, 10 per cent; add for west exposure, 5 per cent.

Through even the best constructed walls a continual current of air passes and whenever a door or window is opened a large volume of warm air is displaced by an equal volume of cold. To overcome this loss and also any loss due to poor construction it is usual to assume the air changed the following number of times per hour:

RESIDENCES.

Halls and rooms opening to outside air	3
Living rooms off heated halls	2
Bedrooms	1

PUBLIC BUILDINGS.

Stores and churches opening to outside air	3 to 6
Offices and rooms off heated corridors	2

One B. T. U. will heat one cubic foot of air 55° or 55 cubic feet of air 1°; hence to find the loss of heat due to changes of air, divide the product of the number of changes per hour, the volume of the room and the difference in temperature by 55.

From what has been said we derive the following formula:

$$L = \left(g + \frac{w}{4} + \frac{cv}{55}\right) t\text{-}t°$$

In this and the following formulæ:

- L loss in B. T. U. per hour.
- g glass area in square feet.
- w wall area in square feet.
- c number of changes per hour.
- v volume of room in cubic feet.
- t required temperature of room.
- $t°$ outside temperature.
- T temperature of radiators.
- t' temperature of influx.
- H heat supplied per hour in B. T. U.
- n number of square feet of radiation.

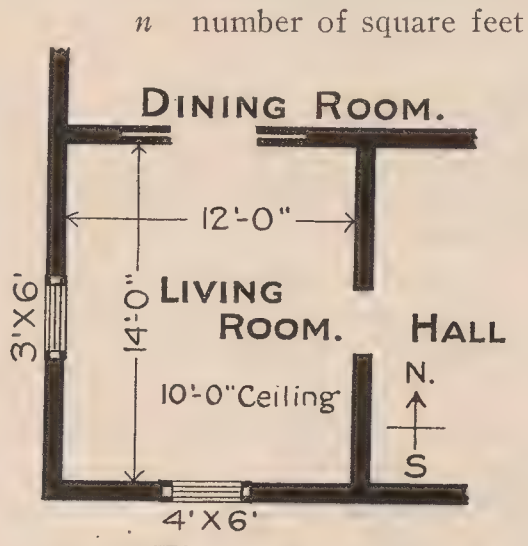

Fig. 1.

EXAMPLE No. 1: Find the amount of heat lost from the room shown in Fig. 1, when the outside temperature is 0° and that of the room 70°.

South exposure = 12′ × 10′ = 120
South glass area = 4′ × 6′ = 24

4) 196 net wall area.

24 equivalent glass.
24 glass area.

48 total glass south.

West exposure = 14′ × 10′ = 140
West glass area = 3′ × 6′ = 18

4) 122 net wall.

31 equivalent glass.
18 glass area.

49
Add 5% for west exposure . . 2

51 total glass west.

Being a living-room off a heated hall, the air will be changed twice per hour, hence $2 \times \frac{12 \times 14 \times 10}{55}$ 61 B. T. U.

It has been shown that 1 square foot of glass is equal to 1 B. T. U. per degree of difference, hence we may add the above results.

South exposure	48
West exposure	51
Changes of air	61
	*160 B. T. U. per degree difference.
	70 difference in temperature.
	11200 total loss in B. T. U. per hour.

RADIATION REQUIRED.

The amount of heat given off by 1 square foot of direct steam radiation may be taken as 1.9 B. T. U. per hour per degree of difference in temperature, hence with steam at 212° and the room at 70°, the emission per square foot per hour would be 1.9 (212-70) 270 B.T.U. If the heat required be divided by the heat given off by 1 square foot, the quotient will be the number of square feet of radiation necessary. In Example No. 1 the heat lost was 11,200 B. T. U. per hour, hence $\frac{11200}{270} = 41.4$ square feet, the amount of radiation necessary to maintain the temperature of the room under the given conditions.

If hot water were used, the average temperature of the radi-

*This is also called the equivalent glass area.

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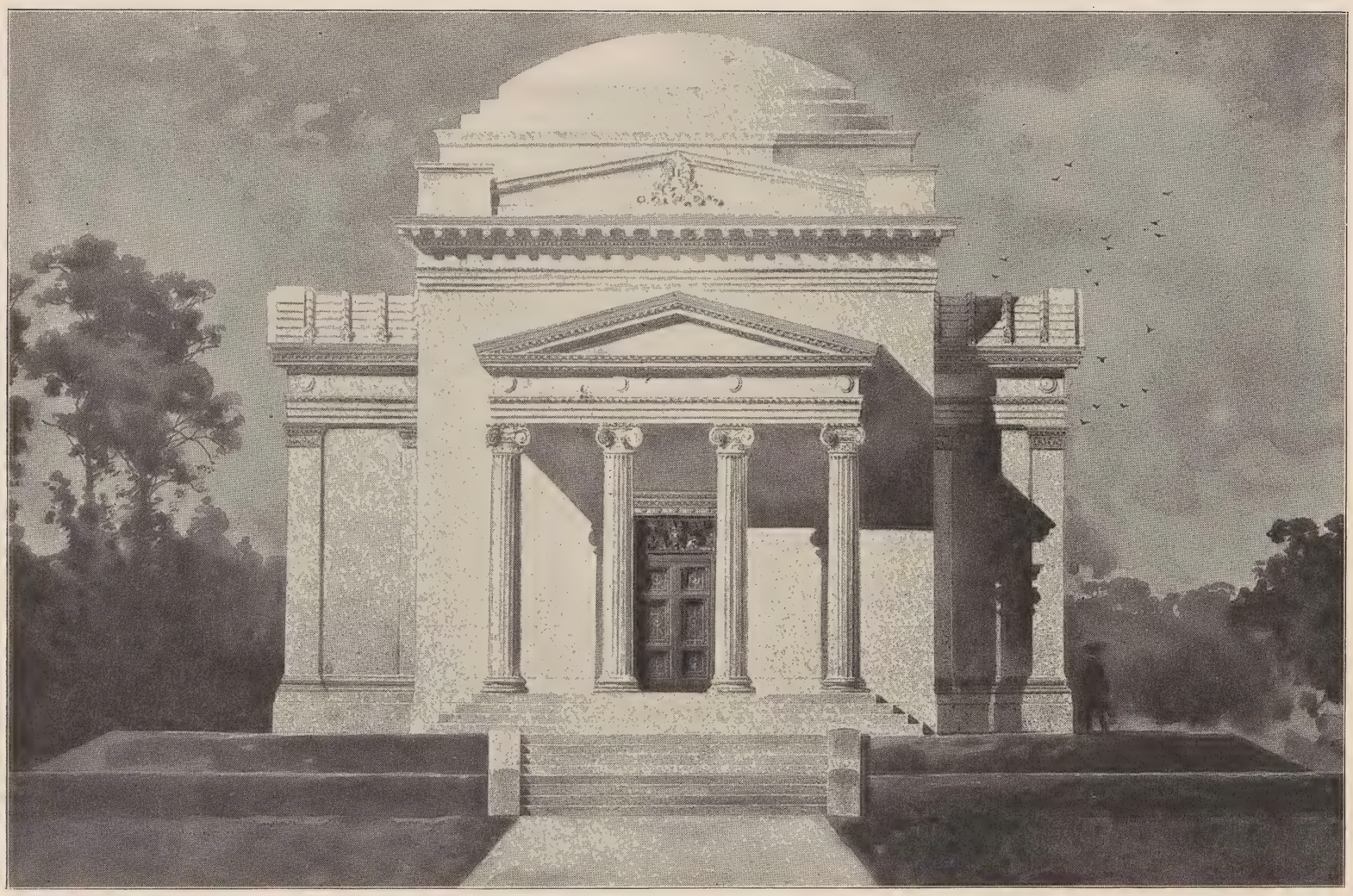

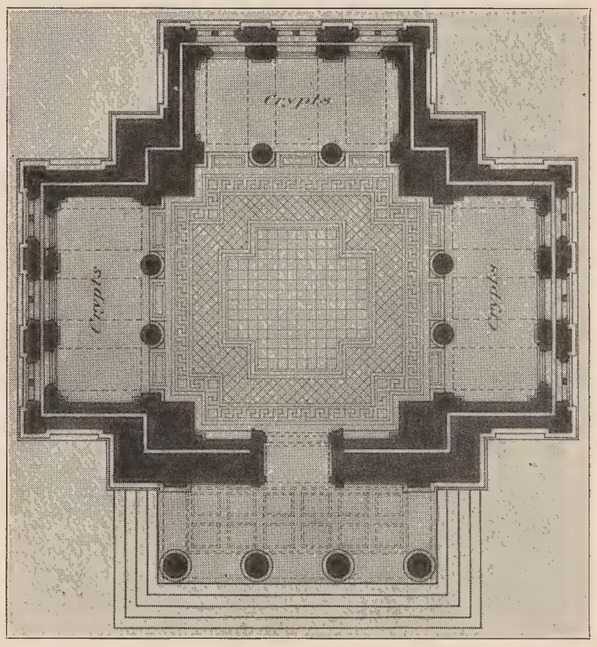

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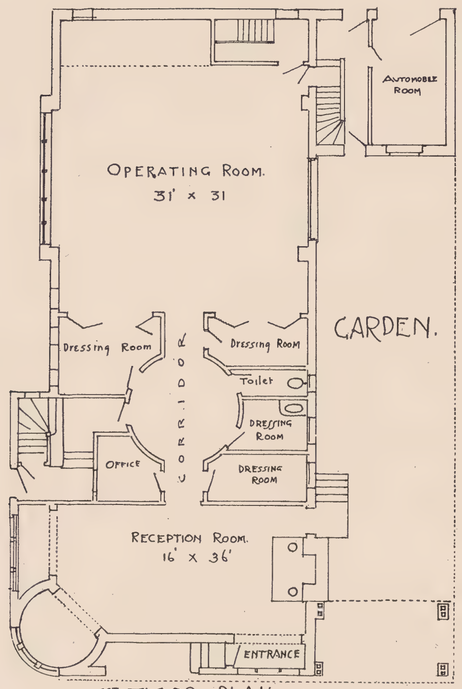
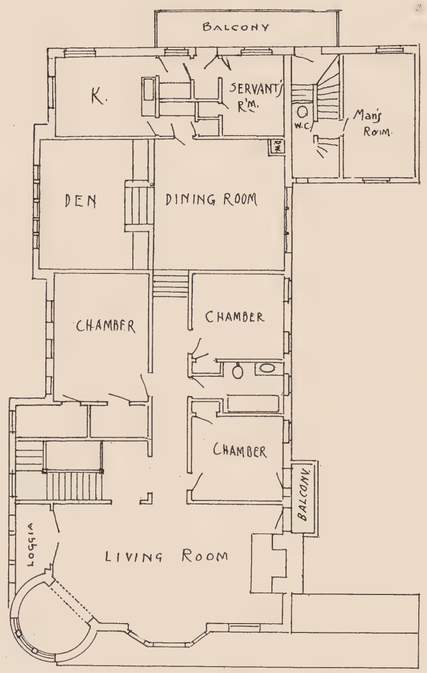
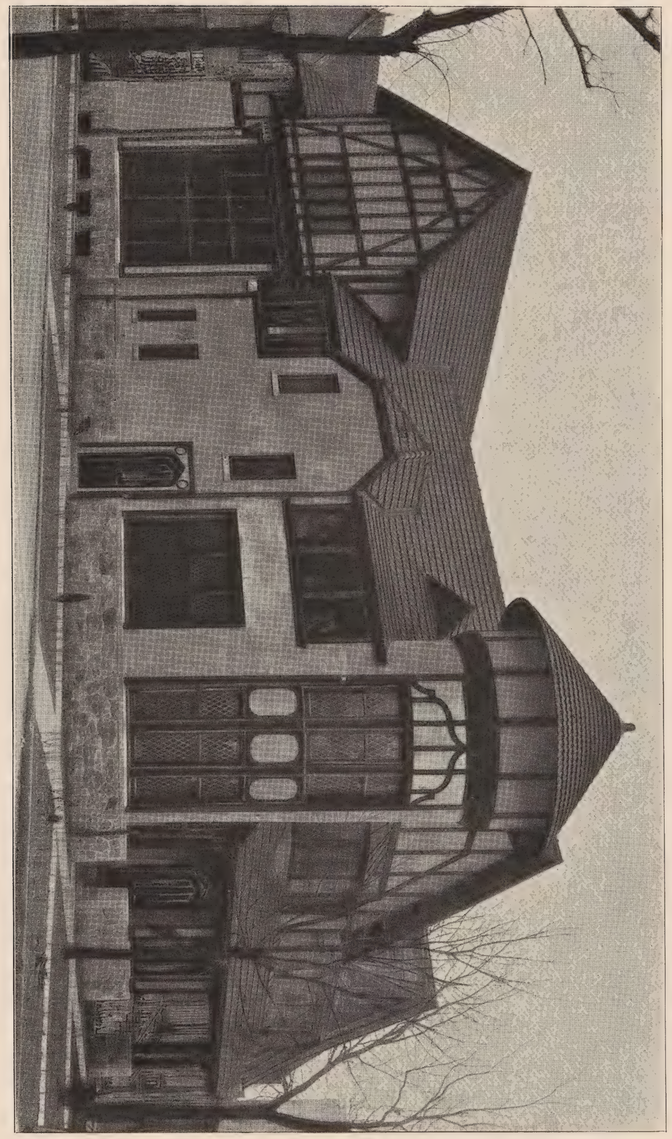


1ST FLOOR PLAN
STUDIO



2nd Story Plan.



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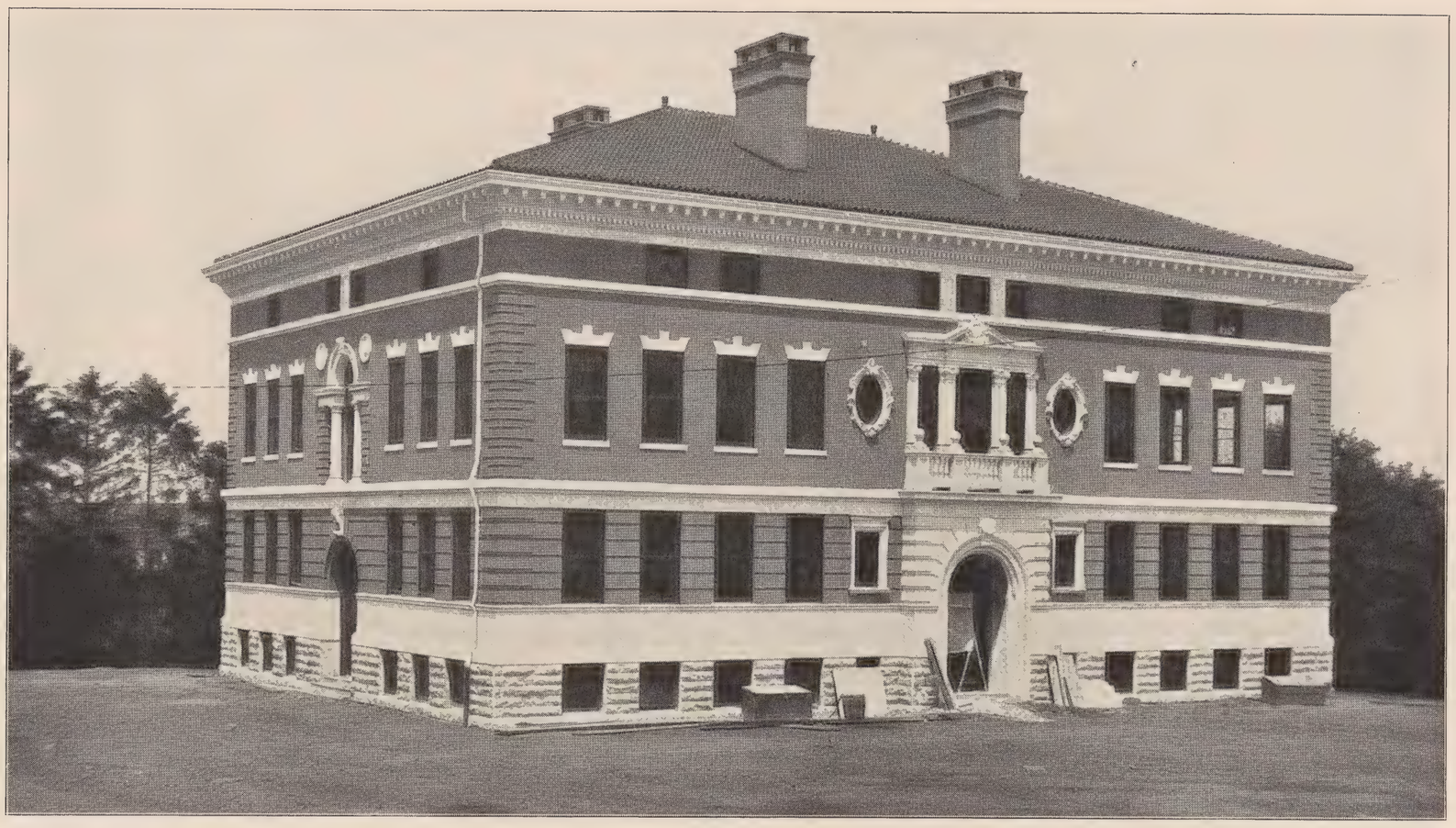

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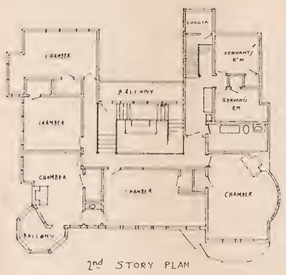
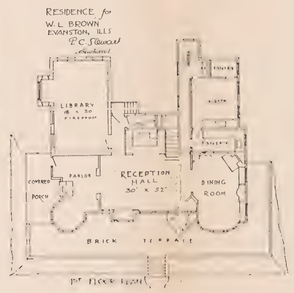
REAR VIEW.



2nd STORY PLAN

FRONT VIEW.



1st FLOOR PLAN

DINING-ROOM.

VIEW IN RECEPTION HALL.

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ators would probably be 175°, and the emission would be 1.6 B. T. U. per hour per degree of difference, which would make the total emission 1.6 $(175-70)=168$ B. T. U. per square foot per hour. Then $\frac{11200}{168}=66.6$ square feet of radiation, if hot water is used.

In these calculations we have found that

No. 1 $L=\left(g+\frac{w}{4}+\frac{cv}{55}\right)t\text{-}t°$

No. 2 $H=1.9\ (T-t)n$ for steam and

No. 3 $H=1.6\ (T-t)n$ for hot water, but it is

obvious that H must $=L$, hence No. 1 = No. 2, or No. 1 = No. 3.

For all ordinary conditions $t=70°$, $t°=0°$, $T=212$ for steam and 175° for hot water, hence $t-t°=70$; No. $2=270n$ and No. $3=168n$, from which we get the following equation:

$$\left(g+\frac{w}{4}+\frac{cv}{55}\right)70=270n \text{ or}$$

$$n=.259\left(g+\frac{w}{4}+\frac{cv}{55}\right) \text{ for steam and}$$

$$\left(g+\frac{w}{4}+\frac{cv}{55}\right)70=168n \text{ or}$$

$$n=.41\left(g+\frac{w}{4}+\frac{cv}{55}\right) \text{ for hot water, all of which}$$

may be expressed in the simple rule:

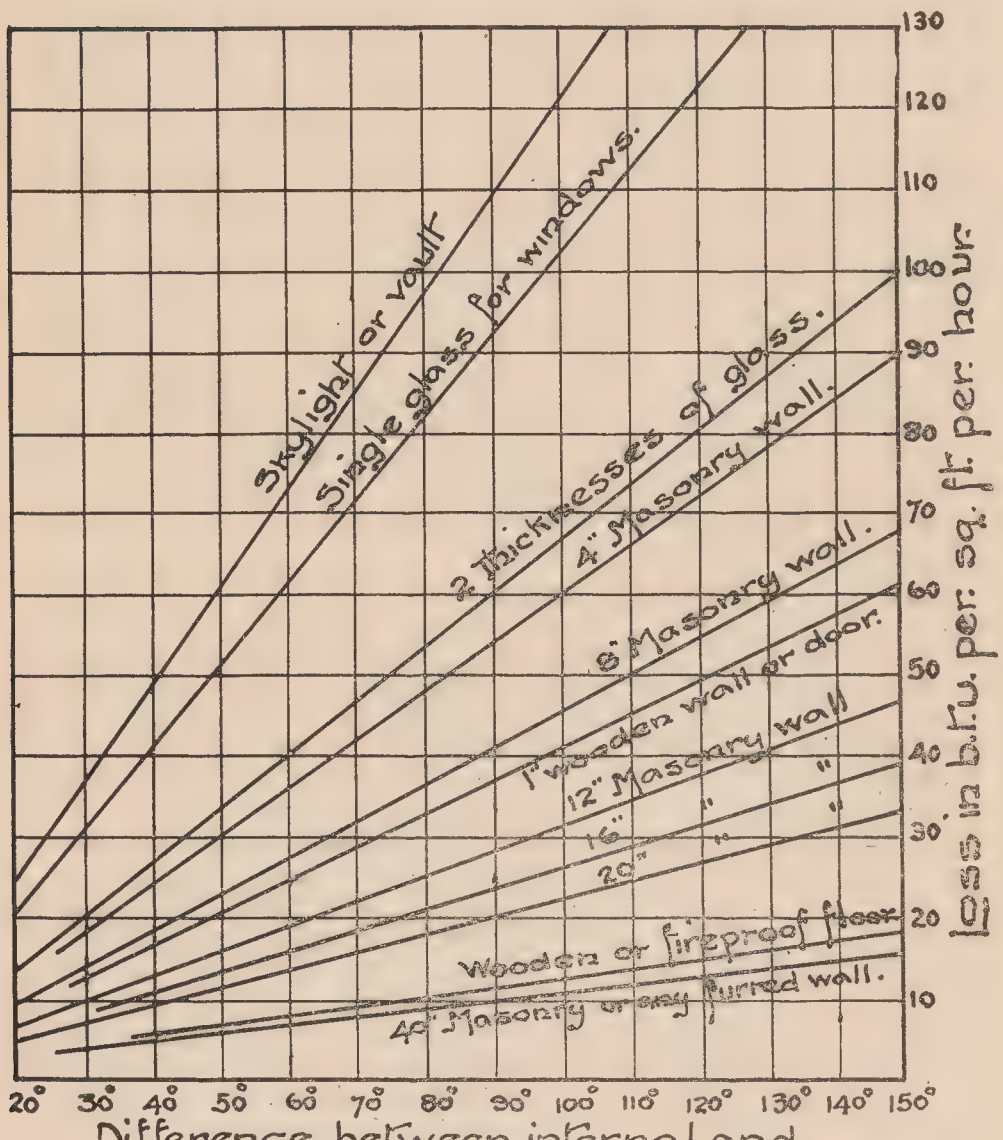
To find the number of square feet of radiation required, multiply the equivalent glass area (which is the same as the loss per hour per degree) *by .25 for steam and by .4 for hot water.*

Diagram No. 1 offers a ready means of finding the radiation required for ordinary conditions.

Diagram No. 2 is for determining the loss from various surfaces under different conditions.

(*To be continued.*)

DIAGRAM Nº 2.



The intersection of the vertical and the diagonal corresponding to the difference in temperature and the kind of surface, respectively, locates the horizontal giving the loss of heat per. sq. foot.

LOSS OF HEAT.

THE EFFECTS OF WIND PRESSURE ON STRUCTURES.

BY ROBERT M. NEILSON.

(Continued from Page 50, Vol. XL, No. 6.)

Another important matter of study in connection with wind pressure is the relative resistance to the wind offered by bodies of different shape. A round chimney is generally supposed to offer less resistance to the wind than a square one of equal height and equal capacity. This can be deduced from De Borda's experiments and from general observations. What is the ratio of the resistances is, however, a question which can hardly be said to be settled.

Rankine gives the formulæ

$$P=ps \text{ for a square chimney,}$$

$$P=p\frac{s}{2} \text{ for a round chimney,}$$

where P denotes the total pressure against the chimney (presumably in the line of motion of the wind), s denotes the area of a diametrical vertical section of the chimney (presumably at right angles to the line of motion of the wind) and p the greatest intensity of pressure of the wind against a flat surface (presumably normal to the wind). According to Rankine, therefore, the resistance of a square chimney with one side facing the wind is to be taken as double that of a round chimney whose diameter equals the side of the square chimney. A round chimney of equal horizontal section to the square one would then have a resistance of 56 per cent of that of the square one.

Trying to arrive at a result by calculation is not of much use unless we know how the air acts on the square and on the round chimney respectively. This we know very little about. If we make certain assumptions, we can by theory find the relative resistances of bodies of different forms. For example, if we assume that wind consists of a series of small particles uniformly distributed and traveling all with the same velocity in parallel paths, and if we assume that when the particles strike a fixed body the angle of incidence is equal to the angle of rebounding, and if we further assume that the particles on rebounding never collide with each other, then the pressure P on a flat surface normal to the wind will be given by the equation

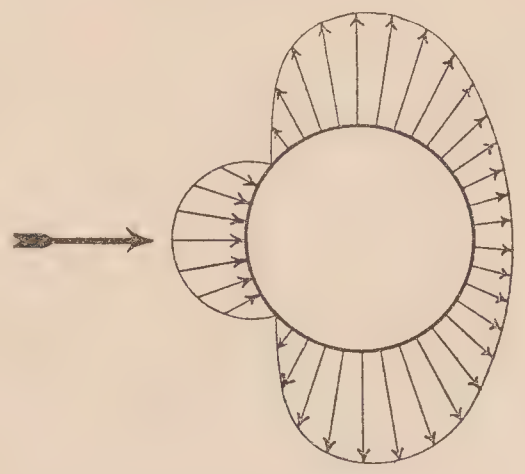


FIG. 6.

Diagram illustrating wind pressure on a cylindrical body

$$P=2Adv^2$$

where A denotes the area of the surface, v the velocity of the wind, and d the density or mass per unit volume.

With the same assumptions the pressure on a cylindrical surface (such as a round chimney) would be $1\frac{1}{3}\ Adv^2$ and that on a sphere would be Adv^2. In the last two cases A is the diametrical section of the body, that is, the product of diameter and height in the case of the cylinder, and π and the square of the radius in the case of the sphere.

According to this reasoning the resistance of a round chimney would be $1\frac{1}{3}\times 56$ per cent, or 75 per cent of that of a square chimney of equal height and horizontal section. Making the same assumptions, the resistance of a square chimney with its sides at 45 degrees to the direction of the wind would equal Adv^2 where A is the section across corners. The resistance of the chimney in this position would therefore be $1/\sqrt{2}$ of the resistance when set square with the wind, that is, rather less than the round chimney of equal capacity.

But however little we know of wind pressure we are certain that the assumptions we have made are not only unwarranted but impossible. The calculations are therefore of little value except for mathematical study. We have however learned experimentally a little about the relative resistance of bodies of different shapes. De Borda's experiments showed with small bodies the pressure on a sphere was 0.41 and that on a cylinder was 0.57 of that on a flat plate. A few years ago M. Le Dantec made careful experiments with falling bodies of different shapes. The bodies were guided to fall vertically, the guide, which was a tightly stretched wire, being practically frictionless. The times of starting, stopping, etc., were automatically recorded on bands of moving paper and other precautions were taken with a view to obtaining great accuracy of measurement. Some interesting and valuable results were obtained. The bodies when let go of course started to fall with an acceleration; but a critical velocity was reached in each case at which the resistance, which varied with the square of the velocity, was balanced by the force of gravity. The velocity thereafter was uniform.*

A square plate of one meter side moving at a velocity of one meter per second was found to encounter a resistance of 81 grams. Plates of equal area but of different shapes — circles, triangles,

* See the *Engineering Magazine*, October, 1899, page 122. Also *Bull. Soc. d'Encouragement*, July, 1899.

etc.—were found to encounter resistances which were nearly proportional to their perimeters, the circle having of course the smallest perimeter and therefore the smallest resistance. The fact already mentioned as having been proved, namely, that large areas offer proportionately less resistance than smaller ones, agrees with M. Le Dantec's experiments, as the perimeters of large areas are relatively less than those of small and similar ones.

M. Canovetti has made experiments somewhat similar to those of M. Le Dantec. M. Canovetti however caused his bodies to move along an inclined wire. The horizontal distance between the ends of the wire was 280 meters and one end was 71.2 meters above the other. The inclination of the wire varied slightly owing to sagging. Times were taken by a stop watch and some of the results obtained are given in the following table:

M. CANOVETTI'S EXPERIMENTS WITH FALLING BODIES.

Form of body.	Pressure in grams.
Circular plate; area one square meter	80
Rectangular plate; area one square meter	90
Hemisphere with convex side foremost; area of diametric section of sphere one square meter	22.5

In all cases the velocity was one meter per second.

It may be assumed that the average pressure on a body will be much the same whether the body is moving and the air at rest or the body at rest and the air moving. Fidler, however, says that "it has not yet been ascertained that the pressure of the wind is the same thing as the resistance offered by the air to a moving body." The pressure in the one case will of course vary much more than in the other.

The following table compares the results obtained by several experiments and formulæ for a certain area and a certain velocity:

Results obtained by different experimenters, and formulæ of the pressure on a circular plate of one square meter at right angles to wind traveling at 1 meter per second.

Formula or experiment.	Pressure in grams.
Rouse's	122
Didion's	88
Dines'	73
Hawskley's	131
Le Dantec's	72
Canovetti's	80
Perfect impact †	249

It is well known that a body of umbrella shape offers a great resistance to air moving against its concave side. This fact is made use of in the parachute, and windmills are constructed on this principle. According to General Didion the resistance of a parachute whose depth is one-third of its diameter is about double that of a flat circular plate of the same diameter. This fact is also borne out by the experiments of Hutton.

The total force exerted by the wind on a plate is, of course, the sum of the positive pressure on the windward side and the negative pressure on the leeward side. For example, if the pressure on the windward side of a plate of 1 square foot area is 50 pounds above atmosphere and that on the leeward side 26 pounds below atmosphere, the effective force on the plate is $50 + 26 = 76$ pounds. The experiments of Du Buat and Thibault seemed to show that the positive pressure on the windward surface of a plate was double the negative pressure or suction on the leeward side. Other experiments, however, lead us to believe that the relative values of positive pressure and suction depend on the shape and inclination of the plate.

The effective force on a plate is found not to be the same as on a prism whose ends are formed by two such plates, the wind pressure being perpendicular to the plate and to the ends of the prism. In spite of the skin friction on the sides of the prism, the effective force on the latter is less than on the plate. This does not seem unnatural when we consider that the air striking the plate or the end of the prism will be projected laterally and will be able to close in again behind the prism much better than behind the thin plate. There will therefore be greater suction behind the plate than behind the prism.

In many cases it is desirable not only to know the total effective force on a body, but the pressure and suction on its front and rear sides separately. Thus, in a house it is necessary to have each wall strong enough to stand the wind pressure or suction (whichever is greatest) as well as to have the house constructed to resist being swept away as a whole. The same thing holds good in box girders or tubular bridges. It should be noted that a wind gauge, which consists of a plate which is exposed both front and rear, will register a pressure which is the sum of the pressure on the windward side and the suction on the lee side.

The question of the pressures on two parallel plates having a space between them not laterally enclosed is also important. Two such plates occur as the girders of a plate-girder bridge. Baker's experiments with equal parallel discs are interesting in this connection. The total effective force on the two discs was found to be as given in the following table:

Distance apart in terms of diameter...	1.0	1.5	2.0	3.0	4.0
Total effective force in terms of effective force on single disc by itself....	1.0	1.25	1.4	1.6	1.8

As there must be a certain amount of force exerted on the leeward disc, it follows that the effective force on the windward disc is reduced by putting behind it at a distance of a diameter another similar disc. That is, not only does the windward disc shield the leeward one, but the leeward disc shields the windward one. And this is what one would naturally expect on a little consideration; for the air between the discs must be comparatively still and suction on the back of the windward disc be very little. In the case of plate-girder bridges, therefore, we may assume that the effective force on the windward girder will be less than if it were alone, and the effective pressure on the two girders will depend on the relation between their heights and their distances apart.

We know that in a gale the velocity of the wind is constantly changing. The maximum pressure recorded by a small gauge therefore will not as a rule measure the force to which a structure is subjected. The small inertia of the gauge will enable it to register the maximum force reached during a puff, but a few feet or even a few inches away the pressure at the same moment may be less. Besides this the maximum pressure may last for only an instant. That is to say, the pressure due to a puff of wind may increase to a maximum and then decrease. For example, at Greenwich on January 16, 1872, the average pressure for each separate hour of six consecutive hours varied from 2.8 to 3.6 pounds per square foot; but the maximum pressure each separate hour was from 30 to 42 pounds per square foot. Now a light gauge will register the very maximum, while the heavy body will be affected only by the average pressure during a small period of time. Consider for example the stability of Cleopatra's needle on the Thames Embankment. We could easily find the uniform wind pressure which would be required to overturn it, but a sudden small gust which merely reached that intensity for an instant would not effect the result; there is more than the weight of the stone to be overcome—there is the inertia. This fact is well illustrated by the way that windows are blown in by gusts of wind which seem to make no impression on the buildings containing the windows, when, by calculation, the windows in many cases ought to stand a greater steady pressure than the building.

A series of comparative tests with gauges which require different amounts of work to make them record would be very interesting and instructive. We might employ spring-actuated plate gauges with large and small masses, or we might cause the pressure on equally massive plates to act on water gauges having large and small sections of tube.

It should be noted that gauges are often affected by buildings or erections in the vicinity and do not register the pressure that would exist in the open. We all know how seriously the draft of chimneys is affected by adjacent objects. It has been suggested that comparatively feeble gusts of wind might rupture a structure if the period of the gusts was equal to the natural period of vibration of the bridge. But the probability of this occurring for more than two or at most three consecutive gusts seems so remote that its effect beyond this possible maximum periodicity may be neglected.

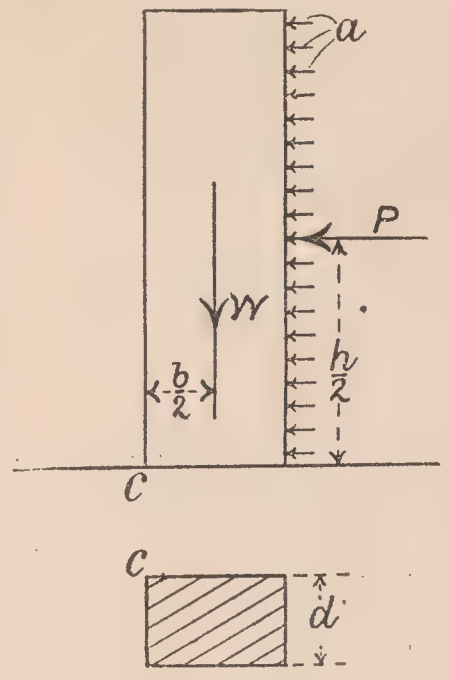


FIG. 7.
Diagram illustrating the stability of a column.

A large structure is more stable than a small one of a similar shape and nature. That is, it takes a greater wind pressure per square foot to overturn a large structure than to overturn a smaller one of the same shape and the same density, if the structures rely on their weights only to resist overturning and if the material is not ruptured. Consider the column shown in Fig. 7, which we will suppose to be of rectangular cross section and to have a height h, a breadth b and a thickness d. Let w be the weight of a unit volume of the material of which the column consists. The small arrows a represent a uniform wind pressure of p pounds per unit area. The large arrow P represents the resultant wind pressure on the column acting at a distance of ½ h from the ground. The large arrow W represents the weight of the column which acts through its center of gravity, the line of W being at a distance of ½ b from the back of the column. Let us take moments about the edge c, c. The overturning wind pressure will be such that the moment of P equals the moment of W.

$$\text{therefore } P \times \frac{h}{2} = W \times \frac{b}{2}$$

$$\text{but } P = hdp$$

$$\text{and } W = hbdw$$

$$\text{therefore } hdp \times \frac{h}{2} = hbdw \times \frac{b}{2}$$

$$\text{therefore } hp = b^2w$$

$$\text{therefore P} = \frac{b^2w}{h}$$

For columns of similar shapes b varies as h, and therefore p varies as one of the linear dimensions. Therefore, if a wind

† That is according to equation near the bottom of page 553.

pressure of 20 pounds per square foot is required to overturn a column 20 feet high, a wind pressure of 40 pounds per square foot will be required to overturn a 40-foot column of the same material and similarly proportioned. If the 40-foot column had a base equal to that of the 20-foot column, instead of being proportionately greater, then the same wind pressure would overturn both. This applies to bodies of any shape.

Fig. 8 shows three columns similar except for their bases, which are equal. These columns are equally stable.

This fact may be expressed by the following rule:

For equal stability against wind pressure, similar bodies require equal bases and not similar bases.

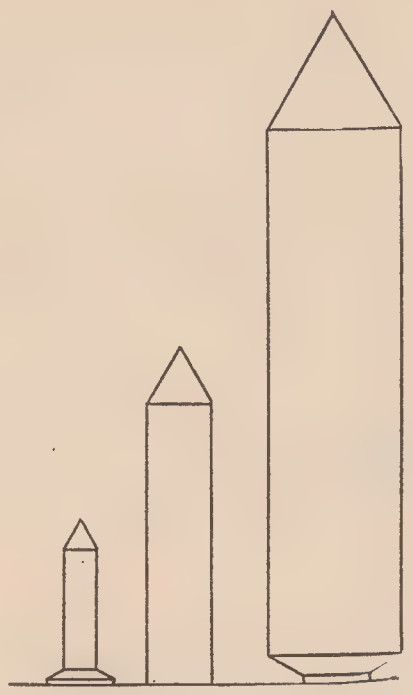


FIG. 8.

Illustrating effect of size on stability.

This rule must be taken as approximate only, for there are several considerations which we have left out of account, such as skin friction of the wind on the sides of the structure, the effect of the friction of the ground on the wind pressure on the front lower part of the structure, and the greater intensity of wind pressure on small than on larger areas. The rule, however, is roughly speaking, correct and explains why in nature an insect has such a large leg base and a large quadruped proportionately such a small one.

We assumed in considering the stability of the column shown in Fig. 7 that it would tilt about the edge *c*. We did this because we were considering stability given by weight only, and not considering the strength of the material. In some cases the material would not fracture and the structure would tilt as has been shown. In other cases the material about the tilting edge would crush. This crushing would not affect the overturning moment, but it would reduce the moment of stability and therefore lessen the wind pressure that the column would stand.

This article will not be complete without a few words on tornadoes. We are not troubled with tornadoes in Great Britain, but in America they occur every now and again and contrive to do a maximum amount of damage in a minimum of space and time. The destructive power of some of these tornadoes has been terrific, but happily their track is usually very narrow and it seems the wisest course as a rule not to attempt to construct buildings to withstand them, but to take the chance, which is really extremely small, of a tornado ever striking them. At a meeting of the American Society of Civil Engineers, the widths of the tracks of several tornadoes were given. The Marshfield tornado was 1,800 feet wide, the St. Charles tornado not more than 60 feet and the Medford tornado had a track only about 13 feet wide.

It is not in the province of this article to discuss the cause of tornadoes. The cause, however, involves a low barometric pressure at some place, and this affects the nature of the destruction caused by the tornado, and the nature of the provisions to withstand it, if such provisions are to be made. In some cases damage seems to be done by suction. In the tornado or cyclone or "vacuum storm," as it has been very appropriately called, which swept through the cities of St. Louis and East St. Louis on the evening of May 27, 1896, there were unmistakable signs of damage having been done by a sudden fall of pressure. Walls of houses in many cases fell outward, evidently due to the excess of pressure inside the houses when the pressure outside was suddenly reduced. The capacity for harm of a sudden fall of pressure will be evident when we consider that every inch of mercury equals a pressure of 70.7 pounds per square foot. If, therefore, the barometric pressure were suddenly reduced outside a building by an inch and a half, the walls of the house would be subjected to the enormous pressure of 106 pounds per square foot. Several houses were found after the St. Louis tornado with walls intact, but with the lath and plaster torn off the ceilings of the rooms immediately below the attics. In these houses there was no flooring on the attics, and the only explanation of the phenomenon seems to be that, when the vacuum wave passed the house, the excess of pressure in the rooms got out by windows or flues or otherwise, but that in the case of the attics with no adequate air exits, the excess of pressure of the imprisoned air burst down the ceilings of the rooms below. In many cases, in which the outside walls of houses were in part thrown down (outward), light partitions and light furniture were left unmolested, showing that there had been no violent air currents inside the house.*

FIFTY THOUSAND DOLLARS for a year's superintendence is the sum mentioned to be given to J. H. Stewart, of James Stewart & Sons, contractors, of St. Louis, for "applying American rush methods" in constructing the Savoy Annex in London.

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* See paper of Mr. Julius Baier, Pro. Am. Soc. Civil Engineers, January, 1899.

REVISION OF THE UNIFORM CONTRACT.

THE report of the Committee on Contracts and Lien Laws of the American Institute of Architects, submitted at the last convention, the full text of which was omitted from the convention report last month, is an interesting document, giving as it does explanation of the different changes in uniform contract form, and the reasons therefor as well as the principal advantages accruing from the use of this form of contract. The report is as follows:

REPORT OF COMMITTEE ON CONTRACTS AND LIEN LAWS.

The Committee on Contracts and Lien Laws has, in accordance with the vote of the Institute at the last convention, in conjunction with a committee appointed by the National Association of Builders, revised and published the Uniform Contract, a copy of which is hereto attached.

The members of the committee on the part of the National Association of Builders were John S. Stevens, of Philadelphia, its president; Charles A. Cowen, of New York city, its vice-president, and William H. Sayward, of Boston, its secretary; all of whom entered upon the work with interest and gave to it much time and thought, especially Mr. Sayward, who acted as secretary of the committee and to whom much credit is due for the care and labor bestowed upon its preparation and printing.

It has been the endeavor of the committee to preserve as much as possible of the form which has been in use for the past thirteen years, omitting such portions as have been deemed objectionable, simplifying it where possible and adding some clauses deemed important. The most notable omission is the clause which designates the architect as the agent of the owner.

Article II has been so modified as to clearly indicate the ownership by the architect of the plans and specifications, and that the charges for their use and for the services of the architect are to be paid by the owner, thus condemning the unprofessional practice which has obtained in some quarters of making contractors pay for detail drawings.

The arbitration clause has been retained, with considerable and important modifications, to make it more effective, hoping thereby to facilitate settlements out of court should disputes arise that from any cause could not be adjusted by the architect.

The committee had before them the form approved by the Royal Institute of British Architects, a form in vogue in Washington and numerous forms from individual architects, some of which it conceives are signed by contractors only because they fear to offend the architects issuing them, or, which is more probable, because they have implicit faith in them for their fair dealing, and believes it has, under legal advice, provided a form which provides for emergencies, deals justly with both owner and contractor, protects the rights of each, will admit of almost universal application and will be used even more extensively than the previous form, which reached a sale of more than five hundred thousand copies, or an average of nearly forty thousand a year.

The committee is aware that a few prominent and older architects are wedded to their own forms and some are able to impose the duty of drawing contracts upon the counsel employed by their clients, but to the great body of practitioners a uniform contract is of great service and it seems to the committee that an advantage of its continual and nearly universal adoption will be to establish its provisions as usual and proper, and thus give it a standing in the courts which no individual contract would possess.

It should be borne in mind that the omission of what to some may seem important, can easily be remedied by writing in and offensive clauses stricken out, both of which would attract at once the attention of both contractors and owners. The former are so familiar with its contents that they do not hesitate to sign it when it has not been changed, and are able to see at a glance where it has been changed, which will readily challenge their consideration.

PHILADELPHIA T-SQUARE CLUB EXHIBITION.

THE T-Square Club opened its annual exhibition of architectural designs and drawings, January 7, filling the gallery of the Art Club, at Broad and Chancellor streets. The T-Square Club has made itself notable in the architectural life of Philadelphia by its determination to present at its annual exhibition, and through various competitions which it holds during the year, both the best student work and the best work of architects who have already attained distinction.

According to the Philadelphia *Press* the exhibition this year has for its two notable showings the monumental work in progress by Mr. Cass Gilbert and Mr. Ernest Flagg. No more important work is to-day under construction than the great group of buildings for the National Naval Academy at Annapolis, whose cost will reach nearly $6,000,000.

The drawings which Mr. Flagg here exhibits were the only ones from this country which received a medal at the Paris exposition. The scheme, which was a difficult one, centers around the chapel, about which are disposed a group of varied buildings handled in a grandiose Renaissance, somewhat heavy but effective.

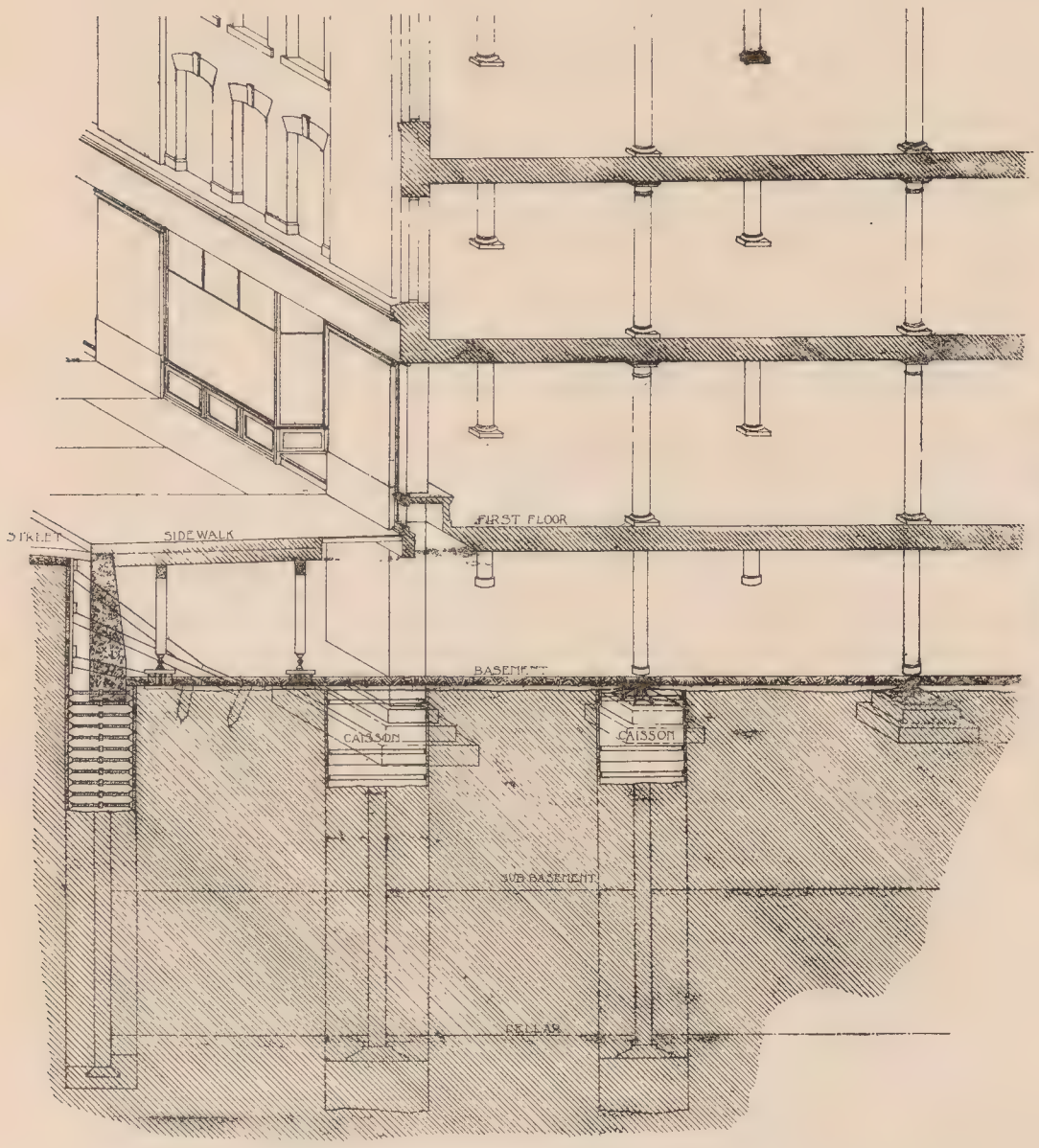
Mr. Cass Gilbert sounds an altogether different note in the façade of the Art building for the Louisiana Purchase Exposition. Attracted doubtless by the success of the Pinakothek in Munich in using a Greek front as a mask for the broad areas of galleries, Mr. Gilbert, working with great simplicity and directness, reducing his decoration to a minimum, securing serenity and ease by an expanse of wall, and at the same time concentrating decoration upon his three façades of columns, manages to combine something of the simplicity of Greek architecture with the broad effect of Roman models.

Next to the work of men who have attained distinction comes the work of those who have distinction before them — the young students whose work is exhibited here. It illustrates the admirable character of the instruction and inspiration imparted by the school of architecture at the university.

Mr. Wilson Eyre is represented by picturesque groups of buildings handled with that singular perception of the value of relation which all his work displays. Architectural drawing can not go much farther than in the suggestive handling of Jules Guerin's residence of Mrs. Robert Lesley. Some charming windows by Nicolo d'Ascenzo are exhibited, together with a nude decorative design less attractive. Original cartoons of the decoration for Keneseth Israel by Gustav Ketterer are interesting examples of pictorial decoration.

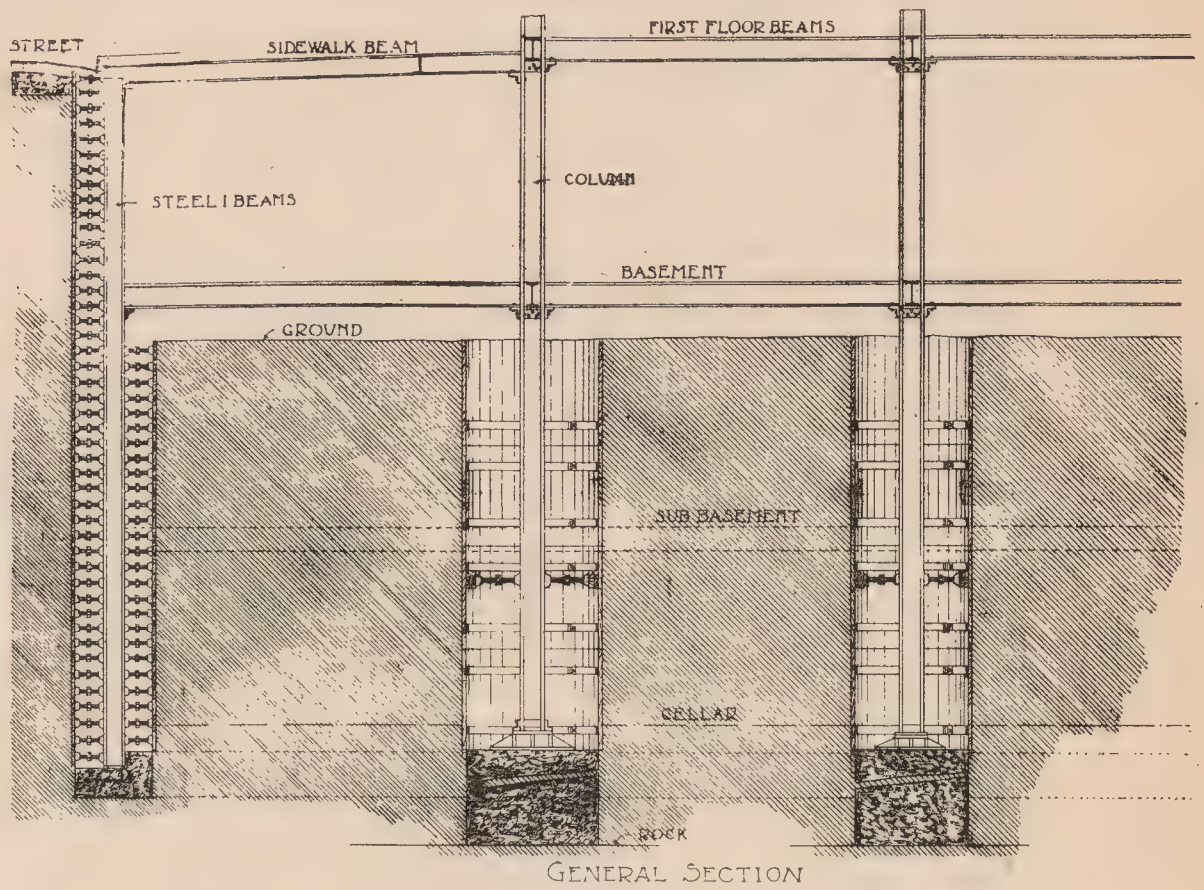
SUB-CONSTRUCTION AS APPLIED TO STEEL BUILDINGS AND SUBWAYS.

THE problems entering into the world of construction and engineering are something incalculable. Like the astronomers who gaze into the starry vaults of heaven and find new bodies and their relative value one to the other, so the engineers and architects are constantly looking into methods, new and old, of construction to discover a way to save labor,



NO. 1. GENERAL SECTION, SHOWING METHOD OF BUILDING RETAINING WALLS. PATENTED JANUARY 13, 1903.

material and time, and the one who hits upon the idea of applying theories to practical use is the successful and progressive mind. One of the most vital points of construction is the building of foundations on a proper foundation. Formerly great openings in the earth were dug, in the trenches of which tons and tons of stone coursing were laid on which to erect the superstructure of almost equally heavy material. Time and new ideas have changed all this. The introduction of the skeleton construction of steel columns and beams has opened up new ways of accomplishing and overcoming the slow, cumbersome methods of a few years ago. And now a new method of accomplishing the quick erecting of a great office building before digging out the earth is presented to the professional world, and without doubt the system just introduced by Mr. John Meiggs Ewen, Marquette building, Chicago, and herewith explained in a terse manner, will interest engineers and architects. As a time-saver it seems supreme. In the first place, it is the inversion of practical foundationwork. Build your foundation first and then dig, while

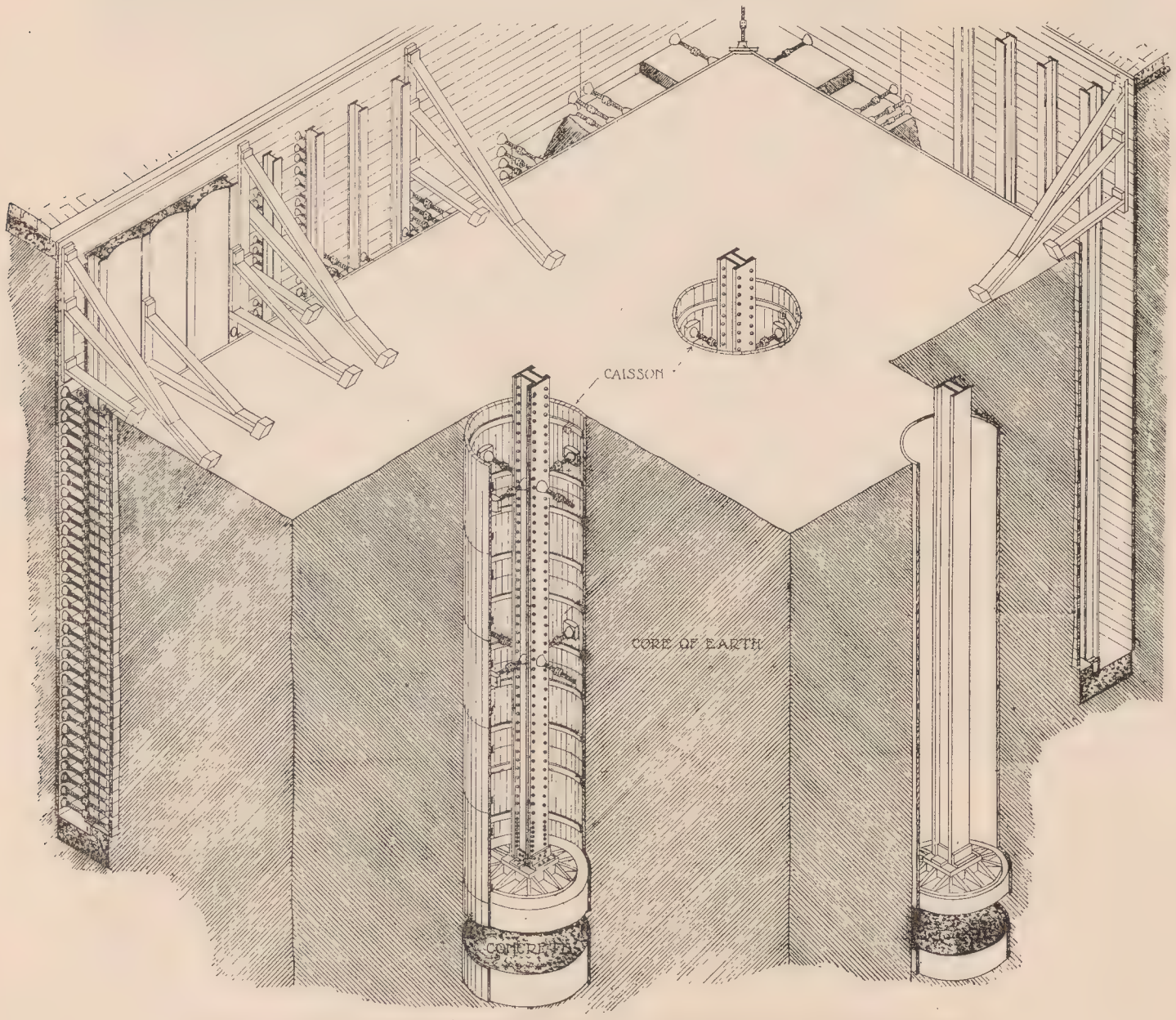


GENERAL SECTION
SHOWING EXCAVATION PARTIALLY MADE.

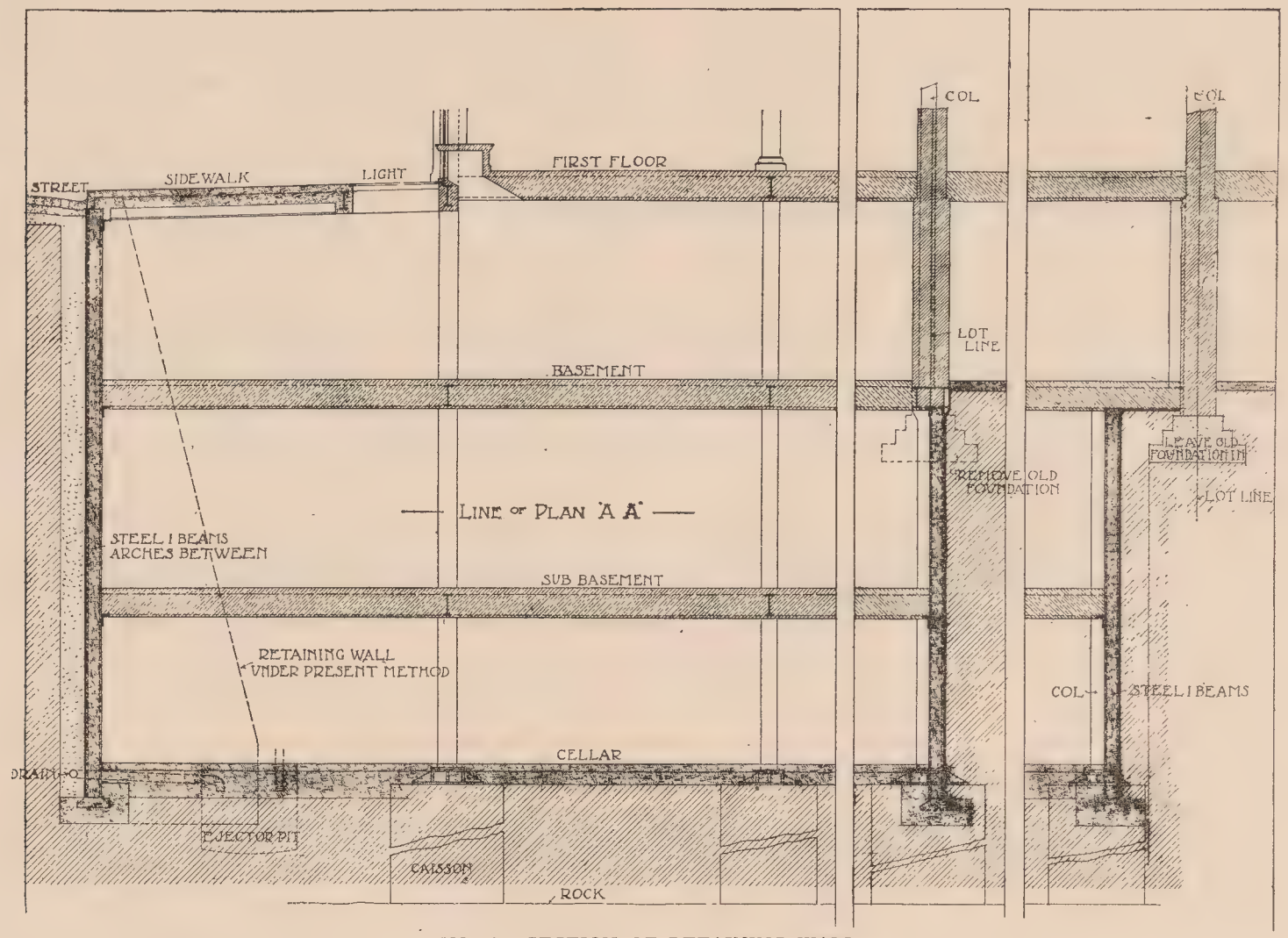
NO. 3.

the superstructure is being erected. Start from your street level and build both ways at the same time, up and down. This is the practical working of the Ewen system.

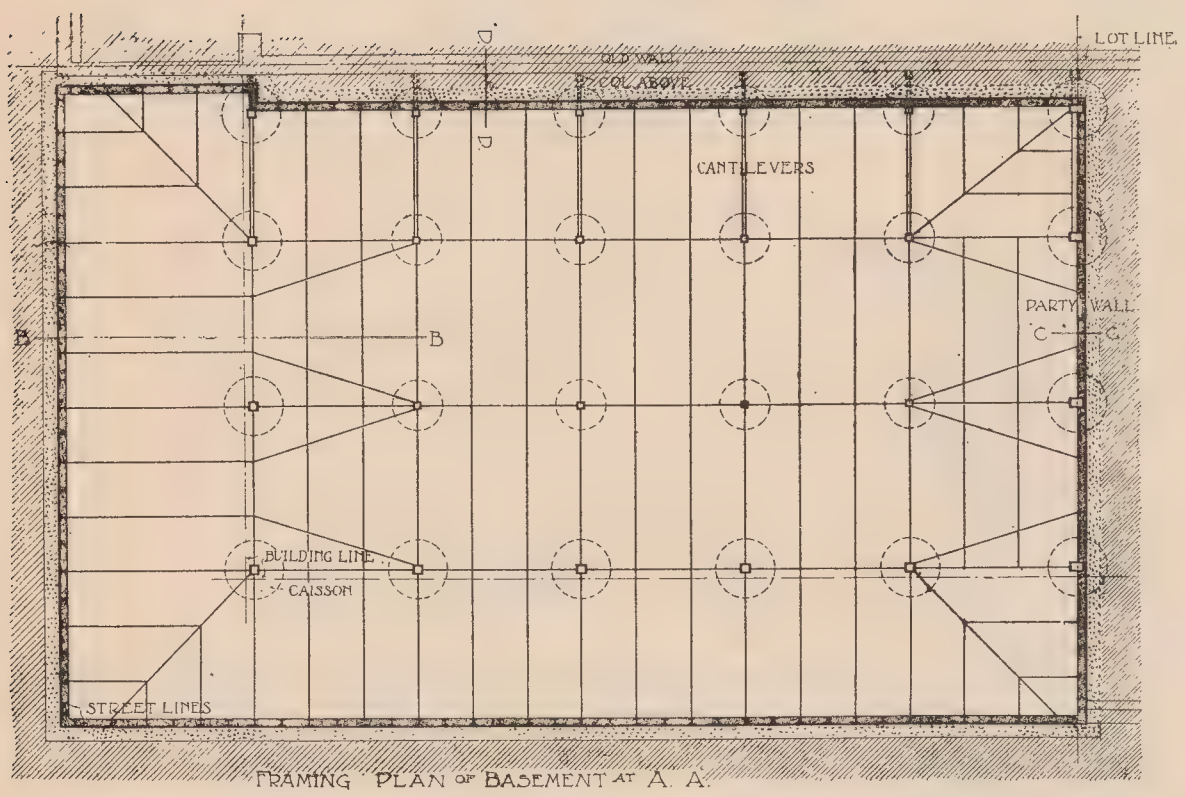
It has, heretofore, been the practice when erecting buildings to remove all the earth, completing the excavation before building the foundations and retaining walls. The new system is explained in cut No. 2. It is at once evident that in removing the earth it becomes necessary to sustain the neighboring streets and adjoining buildings while this work is in operation. The expense, danger and loss of time in doing the work in this manner are very great. The earth under the street and under the foundations of the adjoining buildings must be supported by sheathing propped up by heavy timbers, which of a necessity must be shifted constantly to make room for excavating as it progresses. If a slip or a mistake should be made in removing these props, it would be almost impossible to state the amount of damage that would accrue. It will be at once seen that when this new method is adopted, as shown in Figs. 2 and 3, there can be no danger from the settlement of the streets or adjoining buildings. The excavations need not be finished until after the superstructure is well along. The thick stone retaining wall will be done away with. There will be no shifting of large shores, runways, etc., because these will not exist. There need be no overtime or added expense in connection with the excavation, as the same may be done leisurely, if necessary, after the superstructure is completed. The economies attending the work will be many, for the fundamental principle of not excavating the soil until the substructure is completed, is the logical one. Some of the valuable and economic points in this system are, that when the earth is excavated it can be done by mechanical contrivances attached to the steel beams of the superstructure. The wagons employed for carrying away the earth may drive in from the street on the first floor, thus doing away with runways. The work of excavating can be prosecuted with greater economy, and overtime will be unnecessary. As a time-saver, it might be mentioned that, if the Ewen system had been used on a very prominent building recently erected here, where the excavating went to a depth of thirty-three feet below the street level, at least two months would have been saved in the time of erecting, and so it would be and will be with the great office buildings



NO. 2. CAISSONS SUNK, COLUMNS IN PLACE, READY FOR SUPERSTRUCTURE.

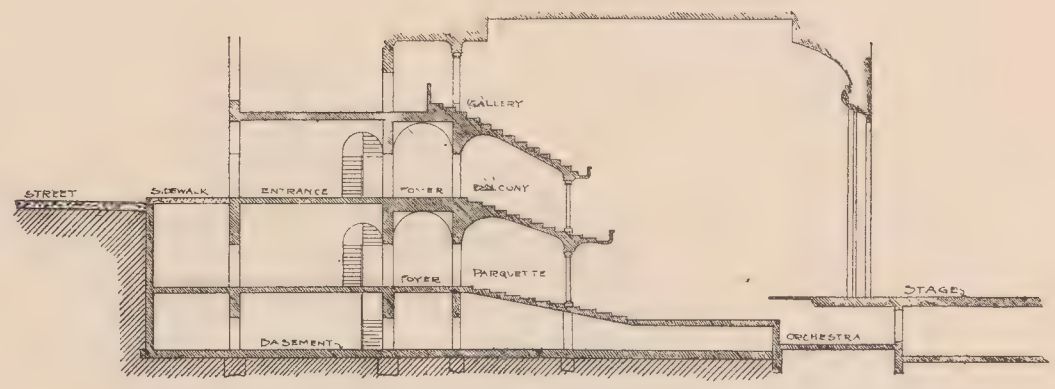


NO. 4. SECTION OF RETAINING WALL.



FRAMING PLAN OF BASEMENT AT A. A.

NO. 5.



THEATER BALCONY ON LEVEL WITH THE SIDEWALK.

NO. 6.

DELIVERY WAGONS LOADING IN BASEMENT INSTEAD OF ON STREET.

NO. 7.

OPEN GALLERIES IN SUB-BASEMENTS FOR STORES WITH GLASS SIDEWALK.

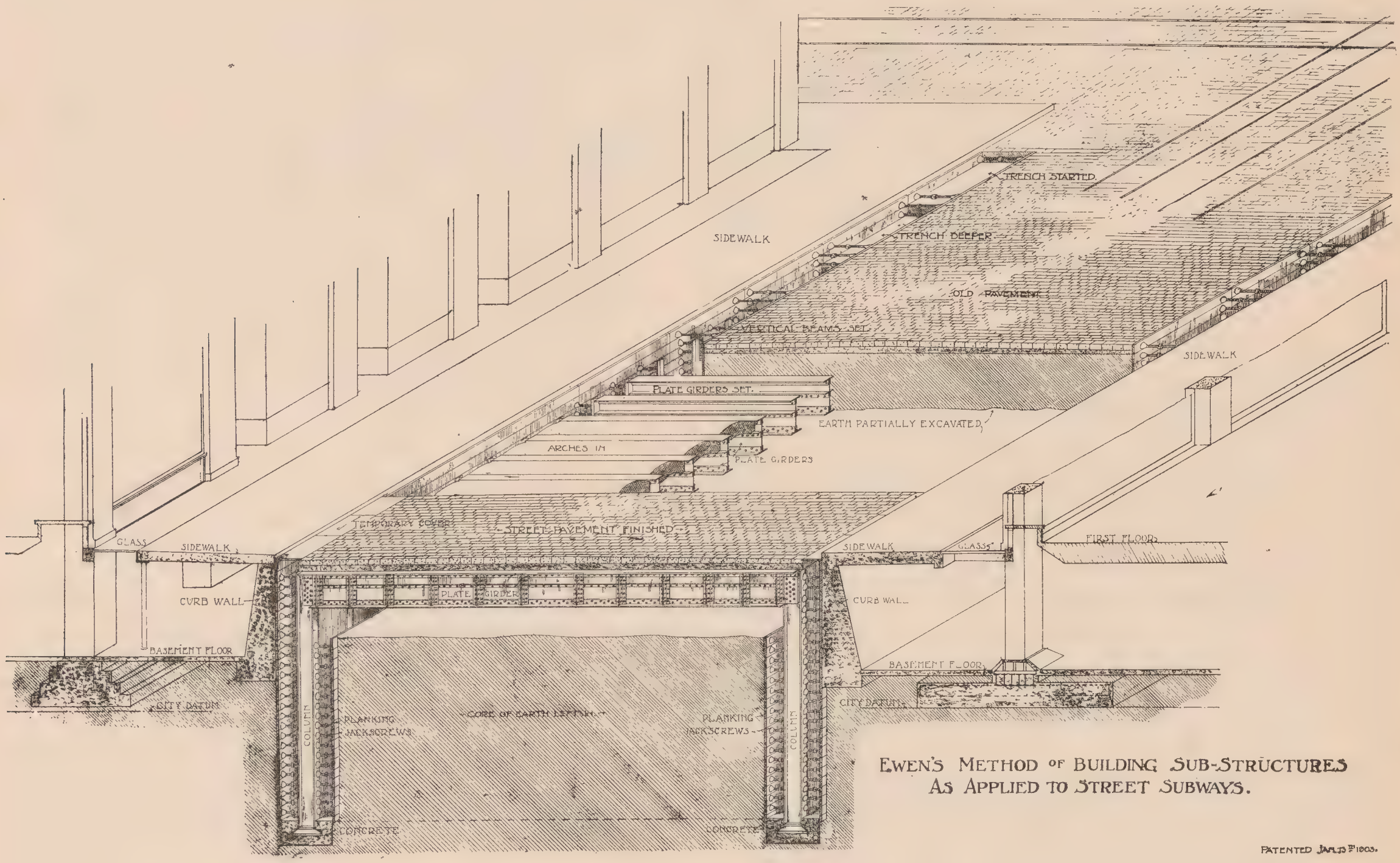
NO. 8.

that are about to be erected, anywhere from two to three months can be saved in the time of erecting these great structures which of necessity will be greatly to the advantage of the owners, architects and contractors.

As property increases in value in the down-town districts, the desirability of adding underground stories to buildings will become more apparent. It is evident that a sub-basement under the large department stores could be very profitably used in connection with the shipping department and loading of wagons, thereby relieving the sidewalks and streets of the annoyance of being blocked so many hours of the day. This system is shown in plan 7. The adoption of this plan would prove an actual saving to the stores and a boon to the public. Large stores could well afford to build several basements underground, leaving the portion directly under the sidewalk which would be built of prismatic light glass, open, as shown in plan No. 8, which would add very largely to the available space of the building. Property is so valuable in London that some of the theaters are built entirely underground. The Criterion Theater is an excellent example, being built directly under the Criterion restaurant, the floor of the restaurant being only a few steps above the street level and forming the roof of the auditorium for the theater. This of course may be an extreme case, but there are many cases where the floor of the first balcony is upon the level of the street, therefore it might be advisable for theaters that are being built in the crowded districts of cities to be erected partially underground, thereby giving equal facilities to the audience to escape in case of fire, as represented in plan No. 6, the Ewen system of sub-construction making this feasible and practical. It is also evident that if the inner courts of large office buildings be continued below the street level, which is possible and practicable with the Ewen system, several desirable floors of court offices may be obtained, with good light and ventilation almost equal to the present second and third court stories. The value of a method that will allow this to be accomplished with impunity becomes apparent to the architect.

Not only is the Ewen system applied to buildings, but to the construction of subways in large cities. The advantages are at once manifest when the matter is understood, and from letters which have been received from the highest authority in the engineering and architectural profession it would show that this method of construction is fully appreciated. The plan of constructing of subways is shown in plan 9, and a study of this plan and plan No. 1, with the short explanation herewith, will probably give one a fair understanding of the system.

The first step is to remove the curb wall and sidewalk, though the latter may be retained, and in lieu of such wall, the usual support is erected. Start a trench along the line of the exterior retaining wall, placing heavy planks on each side and holding them by means of a series of jack-screws. When the first plank has been placed in position, the trench is sunk, say one foot deeper and another set of boards and jack-screws is placed in position. Thus the work is continued to the desired depth, as shown in plan No. 1. The excavation for the columns is made by the usual caisson method. This work is carried down to solid rock or suitable foundation. This hole is supplied with concrete and a column footing. A column is then inserted, supported in the proper manner. In case of considerable depth, the columns must be stayed as by throwing out from the columns supports against the inner walls of the caissons. It will now be possible to begin the upper structure by putting in position I beams and the like and suitably attaching them to the upper end of the exterior vertical beams and to the columns. After a little further excavating the second layer of floor supports can be put in to form the floor of the basement. The earth for the sub-basement may now be removed, also the planks with the inner short jack-screws. This process will continue until the floor line of the sub-basement is reached. The floor beams are in like manner bolted to the walls and columns. In the same manner the cellar excavation is made and the floor of the cellar can be placed in position; thus there will be constructed within the retaining wall, but securely supporting the same by reason of the lateral beams, a steel structure which will constitute the substructure of the building and which will be entirely surrounded, if this be desired, by a retaining wall of steel and concrete. The short jack-screws are then removed one by one and the space between the planks and the retaining walls is filled up with crushed stone or suitable filling material. When the whole process has been completed and the entire structure has been finished, it will be found that there is an exterior wall of vertical I beams and concrete around the building site, and that it is securely attached to and forms part of the structure of the building, as shown in plan No. 4. This retaining wall is held in position by the cross beams and may present a vertical interior face if desired. This substructure may be carried to any desired depth. It is a safe method because the inner core of earth sustains the same pressure at all times during the process of the work. The superstructure may be erected on the columns before the substructure is completed. By the use of this process it is feasible to erect under a standing building a new retaining wall and substructure at any time and without disturbing the occupants of the building. There are undoubtedly many ways in which this system will be applied to sub-construction under many varied and difficult problems which constantly arise in finding a safe bottom for the erection of a massive office building, and time and use will bring out all its values and adaptability to the existing mode of construction.



EWEN'S METHOD OF BUILDING SUB-STRUCTURES AS APPLIED TO STREET SUBWAYS.

PATENTED JAN. 13 1903.

NO. 9.

COMBUSTION.*

BY MORRIS R. EBERSOLE.

THE term "combustion" is applied to any chemical change which is accompanied by an evolution of heat and light, but in its popular sense it is applied to the union of substances with oxygen when this union is accompanied by the same phenomena. A combustible substance is one which has the power to unite with oxygen, and an incombustible substance is one which has not this power. Another class of "combustions," or more properly called "oxidations," are those chemical unions of substances with oxygen which are *not* accompanied by flame or light. Examples of these are: the rusting of iron, the purification of the blood in the lungs, the decay of animal refuse, etc. These things in "combusting," or uniting with oxygen, will evolve heat, but as the action is slow and spread over a long time, the heat evolved does not evidence itself in the form of flame, except in very extraordinary instances. Combustion is exclusively a chemical action. The study of its phenomena by Lavoisier, the French chemist, in the latter part of the eighteenth century, is what put the present elaborate system of chemistry on its feet. A given amount of combustible substance requires an exact chemical equivalent amount of oxygen — no more, no less — to perfectly consume it, and by virtue of this, as all chemical changes give off or use up heat, there will be a definite amount of heat to be obtained, assuming we have burned the substances according to the conditions of "perfect combustion." As the combustion is more or less perfect, the heat effect will be correspondingly large or small, and what remains from the total amount it is possible to obtain will escape in the form of unburned products. Many substances, coal or wood, for example, will not actively combine with oxygen or combust until they have been heated to a high temperature, called the "kindling temperature." In kindling a fire we first start it burning with paper, oil or excelsior, substances which ignite easily because they are easily heated to their kindling temperature; these in turn produce a large flame, which brings the kindling wood to the proper temperature for uniting with the oxygen in the air; and this in its turn affects the coal in like manner, until finally we have obtained a combustion which maintains itself as long as the coal lasts and the supply of air is sufficient.

Perfect combustion is dependent upon the supply of oxygen or air and upon the completion of the chemical union of the products of combustion with it. The more oxygen supplied the more active the combustion. Should the supply of oxygen or air be shut off, the fire would naturally go out; or should this supply be very limited, it might become insufficient to maintain the combustion at the proper temperature and the heat we expect to get would be lost in the form of unburned products.

NEW PUBLICATIONS.

WALL PAPERS AND WALL COVERINGS. A practical handbook for Decorators, Paperhangers, Architects, Builders and House-owners, with many half-tone and other illustrations, showing the latest designs. By Arthur Seymour Jennings. One large 8vo vol.; cloth. Price, $2. New York: William T. Comstock.

Some years ago the author prepared a book under the title of "Practical Paper Hanging," and this book attempts to cover more completely the subject than in the previous work. It is very elaborately illustrated with half-tones of the latest designs of a large number of manufacturers, both in America, England and France, and special chapters are devoted to English, American and French papers.

A chapter is devoted to the selection of wall-papers. Another treats of the different varieties of wall-papers and their characteristics, of wall coverings and decorative fabrics and materials.

Practical questions, such as the tools used, are given very full treatment, with illustrations of the latest devices and full descriptions.

Rules to be observed and suggestions as to meeting difficult or unusual obstacles are given, and the whole subject seems to have been carefully and systematically studied, and is presented in a well-arranged manner, making it a valuable handbook both for the mechanic and designer.

ASSOCIATION NOTES.

NATIONAL BRICK MANUFACTURERS' ASSOCIATION.

The National Brick Manufacturers' Association held the most successful and well-attended convention of its seventeen years of existence at Boston on the 5th, 6th and 7th of February. The visitors were welcomed to Boston by Robert S. Peabody, president of the Boston Society of Architects, and among the many addresses on technical subjects Architect R. Clepston Sturgis spoke on "The Sizes of Brick," in which he made a plea for a standard proportion for brick that would give more artistic proportions to the heads and stretcher. While Mr. Sturgis held out the hope that cheaper brick would supplant the wooden house, Mr. W. G. Titcomb denounced the practice of the manufacturer who sells his product to the contractor for cash where the price is set below the real value of the product.

DETROIT ARCHITECTURAL CLUB.

The Detroit Architectural Club held a special meeting at the clubrooms, February 2. The principal event on the program was the reading of a bill proposed by Architect Thomas E. White, of Lansing, "To license architects and regulate architecture as a profession." The reading of the bill was followed by informal discussion of the subject, after which some important business concerning the coming exhibition was transacted. A number of architects and particularly members of the American Institute of Architects, were invited to be present.

THE ARCHITECTURAL LEAGUE OF NEW YORK.

The eighteenth annual exhibition of the Architectural League of New York opened on February 13 and will close March 7. The exhibits will be discharged March 9.

MOSAICS.

ARCHITECTS GREEN & WICKS, of Buffalo, propose to offer six apprenticeships in their office to boys wishing to enter the architectural profession. A competitive examination will be held and the six adjudged most talented will be given practical instruction in their office and provided with a scholarship in the Art Students' League, the local art school, where they will be taught free-hand drawing and clay modeling. The idea seems worth repeating *ad libitum*.

JUST now London is pointing with pride to what is regarded as the most gorgeous business palace in the world. "Lloyd's Register," as the new building is known, has just been completed at a cost of $500,000. The new building is not large, hence its comparatively small cost. It is constructed of the finest Portland stone, and the exterior is of great architectural beauty. The carvings on the porch and the bronzes between the pillars are by Mr. George J. Frampton, the Royal Academician, and are executed in his best style. The weathercocks are two little ships of copper gilt, one a modern liner and the other an ancient fifteenth-century sailing boat. Valuable marbles, inlaid woods, mother of pearl and even jewels have been utilized in the decoration of the interior. T. E. Collcutt, the architect, recently gave the press some details of his work, which, in beauty of design and wealth of decoration, is indeed a masterpiece. "Quite the costliest part of the building," said Mr. Collcutt, "is the frieze of Lynn Jenkins, representing a procession of medieval ships. The vessels are of bronze, the sky of mother of pearl and the figures of bronze, with ornaments of real sapphires. The faces are carved in ivory." The magnificent fireplace in the library is of marble, carved by H. Pegram, and the ceiling paintings are to be executed by Professor Moira. The ceiling itself is vaulted and profusely decorated with carvings and gilt. Round the paneled walls are inlaid woods. The supporting pillars are of polished marble. The mantelpiece is exceptionally beautiful carved marble. The fire dogs, of old Italian work, stand six feet high and are worth $2,500. Even the clerk's office is more suggestive of a palace than a business house, for it is lined with marble, and the electric-light fittings are of beaten copper. Valuable old Persian carpets cover the floors.

OUR ILLUSTRATIONS.

Apartment building, Chicago.

Residence, Chicago, Pond & Pond, architects.

Apartment building, Chicago, Andrew Sandegren, architect.

St. Bernard School, Cincinnati, Werner & Adkins, architects.

Residence at Los Angeles, California, Locke & Munsell, architects.

Residence for A. E. Hume, Cincinnati, Werner & Adkins, architects.

Photographic studio for E. L. Fowler, Evanston, Illinois, P. C. Stewart, architect.

Stable for J. O. Gilmore, Overbrook, Pennsylvania, W. L. Price, architect, Philadelphia.

Residence for W. L. Brown, Evanston, Illinois, P. C. Stewart, architect. Two exterior views, and view in stairway hall and in dining-room are shown.

Evans mausoleum, to be built in the Woodlands Cemetery, Philadelphia, Wilson Brothers & Co., architects. This mausoleum will be built in accordance with the terms of the will of the late Dr. Thomas W. Evans, the famous American dentist, of Paris, and will cost, with the site, about $200,000. The exterior will be built of granite entirely, including the roof. The interior will be built of polished white marble and mosaics. The building will be built double, that is, with an outer shell and an inner shell, and will be arranged so that it can accommodate twenty-seven crypts or receptacles.

Photogravure Plate: Residence, Chicago, Pond & Pond, architects.

PHOTOGRAVURE PLATES.

Issued only with the Photogravure Edition.

Semi-detached houses, New York city, Hoppin & Koen, architects.

Stables for M. J. Sullivan, New York, Trowbridge & Livingston, architects.

Public Library, Trenton, New Jersey, Spencer Roberts, architect, Philadelphia.

Public school, Wayne, Pennsylvania, David K. Boyd, architect, Philadelphia.

Church, Harvard, Massachusetts; Warren, Smith & Briscoe, architects, Boston.

Residence for J. O. Gilmore, Overbrook, Pennsylvania, W. L. Price, architect, Philadelphia. Two views are shown.

*From *The Boiler Magazine*, Kellogg-Mackay-Cameron Company, Chicago. See ad. in this journal.

GAS FITTERS' RULES

The following rules have been adopted by the People's Gas Light & Coke Company, of Chicago, governing the piping of buildings for the distribution of gas for light and fuel.

OFFICE BUILDINGS, DWELLINGS AND FLATS.

MANUFACTURED GAS FOR LIGHT.

The following tables show the proportionate size and length of tubing allowed:

Size of Tubing.	Greatest Length Allowed.	Greatest Number of 3/8" Openings Allowed.
3/8 inch	20 feet	2 openings
1/2 inch	30 feet	3 openings
3/4 inch	60 feet	10 openings
1 inch	70 feet	15 openings
1 1/4 inch	100 feet	30 openings
1 1/2 inch	150 feet	60 openings
2 inch	200 feet	100 openings
2 1/2 inch	200 feet	200 openings
3 inch	300 feet	300 openings

Drops in double parlors, large rooms and halls of office buildings must not be less than 1/2 inch.

STORES, HOSPITALS, SCHOOLS, FACTORIES, ETC.

MANUFACTURED GAS FOR LIGHT.

Size of Tubing.	Greatest Length Allowed.	Greatest Number of 1/2" Openings Allowed.
1/2 inch	20 feet	1 opening
3/4 inch	60 feet	8 openings
1 inch	70 feet	12 openings
1 1/4 inch	100 feet	20 openings
1 1/2 inch	150 feet	35 openings
2 inch	200 feet	50 openings

For stores the running line to be full size to end of last opening.

All drops to be 1/2 inch with set not less than 4 inches.

Twenty feet of 3/8-inch pipe allowed only for bracket lights.

BUILDING SERVICES.

In running service pipe from front wall to meters the following rules will apply:

Size of Opening.	Greatest Length Allowed.	Greatest Number of 3/4" Openings Allowed.
1 inch	70 feet	1 opening
1 1/4 inch	100 feet	3 openings
1 1/2 inch	150 feet	5 openings
2 inch	200 feet	8 openings

All openings in service must be equal to the size of riser, which in no case must be less than 3/4 inch.

MANUFACTURED GAS FOR FUEL.

Size of Tubing.	Greatest Length Allowed.	Greatest Number of 3/4" Openings Allowed.
3/4 inch	50 feet	1 3/4-in. or 2 1/2-in.
1 inch	70 feet	2 or 1 3/4-in. and 2 1/2-in.
1 1/4 inch	100 feet	4 or 2 3/4-in. and 4 1/2-in.
1 1/2 inch	150 feet	7 or 4 3/4-in. and 6 1/2-in.
2 inch	200 feet	15 or 8 3/4-in. and 14 1/2-in.

For mantels, grates and small heating appliances, for heating space not to exceed 1,728 cubic feet, thirty feet of 1/2-inch pipe is allowed for one opening only, and two such openings are considered as one 3/4-inch opening.

FOR GAS ENGINES.

Size of Engine.	Size of Opening.	Greatest Length Allowed.
1 H. P.	1 inch	60 feet
2 H. P.	1 1/4 inch	70 feet
5 H. P.	1 1/2 inch	100 feet
7 H. P.	1 1/2 inch	100 feet
12 H. P.	2 inch	140 feet

Supply for gas engine must be separate, and an independent service will be required.

NATURAL GAS FOR FUEL.

Classification of Appliances.	Size of Openings	Greatest Length Allowed.
Small portable gas cooking stove	1/2 inch	20 feet
Small portable gas heating stove	1/2 inch	20 feet
Kitchen boiler heater when separated from range	1/2 inch	20 feet
Miscellaneous appliances consuming less than 15 cubic feet per hour each	1/2 inch	20 feet
Gas cooking ranges	3/4 inch	30 feet
Ordinary coal ranges, equipped for the use of gas	3/4 inch	30 feet
Large heating stoves	3/4 inch	30 feet
Gas logs and other grate fires	3/4 inch	30 feet
Miscellaneous appliances consuming 15 to 40 cubic feet of gas per hour each	3/4 inch	30 feet
Miscellaneous appliances consuming 40 to 75 cubic feet of gas per hour	1 inch	60 feet
Hot air furnaces for heating 10-room buildings or less	1 1/4 inch	70 feet
Hot air furnaces for heating 10 to 15-room buildings	1 1/2 inch	100 feet
Low pressure steam or circulating water boiler for heating 10 rooms or less	1 1/2 inch	100 feet
Low pressure steam or circulating water boiler for heating 10 to 15 room house	2 inch	140 feet
Low pressure steam or circulating water boiler for heating 16 to 26 room houses	2 1/2 inch	100 feet
Low pressure steam or circulating water boiler for heating 27 to 50 rooms	3 inch	300 feet
Low pressure steam or circulating water boiler for heating 50 to 80 rooms	4 inch	400 feet

For special purposes not provided for above, apply to the company's inspector for information.

SUMMARY.

1. All branches or cross lines of pipe from the main line must have a set not less than 4 inches dropped square, and must be well secured to joist by gas hooks or straps.

2. All openings must be closed with iron caps, no split pipe or broken fittings repaired with cement or lead will be allowed.

3. All drops on branch lines and openings for side brackets must be square bends; no nipples allowed.

4. The risers in all buildings must be carried up an inside partition out of reach of frost and must be placed where the meter and stop cock can be readily got at. Vestibules not to be considered as inside partitions.

5. To avoid trapping, gasfitters must grade all pipes to risers or drops.

6. In no case will a meter be set where it is not easily accessible, or where it is exposed to frost and dampness, or liable to injury from any cause.

7. All pipe for fuel must be run independent, and connected to light riser at meter end, with right and left, union or running thread.

8. Supply for gas engines must be separate, and an independent service will be required.

9. Drops in churches, schools, public halls, stores, double parlors, large rooms, etc., must not be less than 1/2 inch.

10. No riser in any building must be less than 3/4 inch and in stores must not be under deck of show windows, as meter will not be set there.

11. The riser in any building must not be less than 20 inches from the floor for two to ten openings:

2 feet 6 inches for ten to thirty openings;
4 feet for thirty to sixty openings;
5 feet for sixty to one hundred openings;
6 feet for over one hundred openings.

Where meters are to be set on wall, no riser must be higher than 9 feet from floor.

12. In all cases where extensions are made, care must be taken to break pipe where the rule for size can be maintained, and in no case shall extension be made from small pipes.

13. In flat buildings meters should be set in basement or in room provided for meters; otherwise in premises where gas is consumed.

14. All risers and building services must be brought to front of building and within 18 inches of wall or partition, and must not be less than 15 inches apart where risers are grouped.

15. In all cases where building service is used, provide header with an opening for each riser; where risers are in groups, openings must not be less than 15 inches apart.

16. Underground work by gasfitters between main and meter will not be allowed or accepted.

17. To avoid complications, gasfitters should consult this company before locating risers in corner buildings.

18. In flat buildings where appliances are installed for the joint use of tenants, such as laundry stoves, driers, etc., run pipe from each meter to laundry and provide a header with a lock cock for each tenant. Fasten securely to each cock a metal tag with the flat number plainly marked thereon.

In cases where one common riser is desired, locate header in laundry and provide lock cocks and tags as provided above.

19. All work must be proved with mercury gauge, not less than a 6-inch column of mercury being allowed.

20. All pipe must be examined by the inspector of this company before being concealed, and twenty-four hours notice must be given by gasfitters when any pipe is ready for inspection.

21. If the rules concerning the size of pipes are not clearly understood in each case, or if unusual conditions are met with, which the rules do not cover, communicate with the company's inspector.

22. It is the purpose of the company to strictly enforce the above rules, and no certificate of inspection will be given when they are not complied with.

23. Architects, builders and owners of buildings are requested not to allow a bill for gasfitting unless accompanied by a certificate of inspection.

SPECIFICATIONS

Adopted by the People's Gas Light and Coke Company, of Chicago, for the equipment of boilers and furnaces for the use of natural gas as fuel.

LOW-PRESSURE STEAM AND HOT WATER CIRCULATING BOILERS.

1. Use two-inch cast-iron burner with flattened mouthpiece. For water-leg boilers use this style with a mouthpiece at an angle of 45 degrees, and set so that the mouth of the burner is about 3 inches above the grate line, and about 3 inches from side of fire-box and from 8 to 10 inches center to center. For return tubular boilers use the straight burners with flattened mouthpiece set at right angles to the length of the boiler, and from 9 to 12 inches below the shell. For each of the above styles of burners use mixer having flaring opening for the air and a wire screen covering for the air and gas openings.

NOTE.— Special combinations of these two styles of burners can be used to advantage for certain types of boilers. We would recommend consultation with the company's representatives in all special cases.

2. The burners and valves should be arranged so that the first valve will control one burner only, the second valve two burners and remaining valves not over four burners each. On the reaches from the header supplying the burners, use ½-inch globe valve for one burner, ¾-inch for two burners and 1-inch for all over two burners.

3. Drill mixer-pins for the single and double burners, 3-16 inch each. Drill mixer-pins for balance of the burners, 7-32 inch each.

4. Place sheet iron across the fire-box between the mixers and the top of the burners in such a manner as to exclude air from the fire-box, except what passes through the mixers. Do not place sheet iron across opening to ashpit.

5. The header must be the full size of the pipe leading to the boiler, as specified in the company's rules for piping for natural gas. Do not take the supply pipe for any other appliances off the header supplying the boiler.

6. There must be a globe valve on the main line leading to the header within easy reach, which can be used to entirely shut off the supply of gas from the header. This valve should be left wide open when burners are used, and the gas supply controlled by the small valves in front of boiler.

7. There must be a union between the first valve on the header and the nearest fitting on the pipe, and a union on each reach between the valve and the burners.

8. Do not put in pilot lights. They are unnecessary unless a regulator is used. If a regulator is used, the pilot lights will be put in by the regulator company at the time the regulator is installed. If a regulator is ordered, specify that there must be a mixer on each pilot light.

HOT-WATER HEATERS.

For water heaters with circular fire-pots, such as the Wilks, Tobasco, etc., or for small hot-water circulating boilers, use the same equipment as for ordinary hot-air furnaces, except that if Vulcan burner is used it should be covered with about 6 inches of broken firebrick.

HOT-AIR FURNACES, WITH CIRCULAR FIRE-POTS.

Use the Claybourne Improved Cross Burner, with auxiliary, or the Vulcan Round Sectional Burner, with mixers which have flaring opening for air and wire screen covering both air and gas openings.

DIRECTIONS FOR INSTALLING CROSS BURNERS.

1. Set the burner with bottom of burner on grate line. Put mixer for the main burner on horizontal pipe, using a 10-inch nipple between the mixer and the ell turning up toward the burner. Drill opening in mixer-pin ¼ inch. Place the mixer for the auxiliary burner on the vertical pipe and drill the mixer-pin No. 19 Morse drill. Place the iron deflector, furnished with burner, on top of auxiliary burner, leaving not less than 2-inch space all around between deflector and fire-pot. If space is greater than 5 inches, extend deflector with firebrick.

2. Sheet iron must be placed between the mixers and the burners in such a way as to entirely exclude air from the fire-pot, except what passes through the mixers.

3. Make header for furnace same size as run to the furnace, with 1-inch opening for main burner, and ½-inch opening for auxiliary burner.

4. Use 1-inch globe valve for main burner and ½-inch globe valve for auxiliary burner.

5. There must be a globe valve on the main line leading to the header within easy reach, which can be used to entirely shut off the supply of gas from the header.

6. There must be a union between the first valve on the header and the nearest fitting on the pipe.

7. Do not use pilot lights. They are unnecessary unless a regulator is used. If a regulator is used, the pilot lights will be put in by the regulator company at the time the regulator is installed. If a regulator is ordered, specify that there must be a mixer on each pilot light.

DIRECTIONS FOR INSTALLING THE VULCAN ROUND SECTIONAL BURNER.

1. Burners from 14 to 18 inches in diameter must be of at least three sections, with a separate ½-inch globe valve controlling the supply of gas to each section.

2. Burners 20 inches in diameter or more must be of at least four sections, with a separate ½-inch globe valve controlling the supply of gas to each section.

3. Burners should be placed so that the outside rim of the burner will be not less than 1 inch, or more than 2 inches, from the side of the fire-pot.

4. Burners should be placed from 2 to 6 inches above bottom line of fire-pot.

5. There must be a globe valve on the main line leading to the header within easy reach, which can be used to entirely shut off the supply of gas from the header.

6. There must be a union between the first valve on the header and the nearest fitting on the pipe.

7. Sheet iron must be placed between the mixers and the burners in such a way as to entirely exclude air from the fire-pot, except what passes through the mixers, and should be not less than 2 inches below the burner.

8. Make openings in the mixer-pins for each section of the burner the size of No. 19 Morse drill.

9. Mixers must be put on the vertical pipes under the burner, and not on the horizontal pipes from header to ashpit.

10. Do not use pilot lights. They are unnecessary unless a regulator is used. If a regulator is used, the pilot light will be put in by the regulator company at the time the regulator is installed. If a regulator is ordered, specify that there must be a mixer on each pilot light.

HOT-AIR FURNACES WITH SQUARE FIRE-BOXES.

For furnaces having a square fire-box use the Claybourne box burners, or the Holland box burner. Cover with 4 to 6 inches of broken firebrick. Pieces of firebrick should be about the size of fist. These burners should be set about 6 inches from center to center, with a separate valve controlling the supply to each burner. Drill the mixer-pins for either of these styles of burners, No. 19 Morse drill.

NOTES.

1. The above specifications are the result of careful experiments made by the company with a view to determining the kind of burners and arrangement which give satisfactory and economical results. The company does not assume any responsibility for the work of gasfitters, but will send competent inspectors, if requested, to examine burners and equipment and will give the benefit of the judgment of these inspectors to consumers, without charge.

2. It is of the utmost importance in all cases that there should be dampers which will effectually control the draft and remain set in any position desired. The pipe leading to the chimney and the chimney flue should be examined and cleaned. Too much draft is expensive, because of the waste of heat up the chimney. Too little draft causes imperfect combustion and a bad odor from the products of combustion in the basement and throughout the house. Good dampers and proper adjustment of them are as important as good burners.

3. As natural gas is becoming more and more generally used in all kinds of appliances, it frequently happens that special forms or arrangements of burners are necessary. The company's representatives will be pleased to consult with gasfitters or customers in regard to what form of equipment would be most likely to give satisfactory results in any special cases.

THE INLAND ARCHITECT AND NEWS RECORD

Vol. XLI. ADVERTISERS' TRADE SUPPLEMENT. No. 1

AN UP-TO-DATE TRAIN.

The New York Special to New York State points, New York and Boston, via Michigan Central, leaves Chicago daily 5:20 P.M., arrives Buffalo 7:50 A.M. next day, New York 6:30 P.M., Boston 9:03 P.M., running via Niagara Falls. O. W. Ruggles, general passenger and ticket agent, Chicago.

A TOOT FOR GRAPHITE.

Dixon's Graphite is so well and. favorably known, and has been so long upon the market, that to call attention to its value is almost superfluous. The Joseph Dixon Crucible Company, of Jersey City, New Jersey, have, however, just issued a unique booklet treating in an entertaining manner of the various purposes to which their production is applied, especially as regards the reduction of friction in machinery. This will be found of considerable value to those who may be interested in automobiles, to which it is largely devoted, while the cuts that embellish the text are well calculated to provoke smiles in response to their humor.

A FIFTY-FOOT CALENDAR.

N. W. Ayer & Son, the Philadelphia advertising agents, who have a national reputation for "keeping everlastingly at it," believe in sticking to a good thing when they have one. For instance, their calendar for 1903 follows the design used for several years past, but with new coloring. And in truth it would be hard to improve upon their design; the dates are plainly readable at fifty feet, yet the calendar is not unpleasantly conspicuous; it is artistic, simple and useful, and it is not surprising that it has become so popular an adjunct to business offices that the supply never equals the demand.

While they last, one will be mailed to any address for 25 cents, which barely covers cost and postage.

FASTEST TRAIN IS THE EMPIRE STATE.

By an official change in the running time of the Southern Express, the flyer of the Orleans Railway, of France, the Empire State Express, of the New York Central & Hudson River Railroad, has regained its lost title of "the fastest train in the world."

When the Empire State Express started on its first race toward Buffalo, more than ten years ago, it established a long-distance record which was not excelled until the Orleans Railway inaugurated its Southern Express, which runs from Paris to Bayonne.

There were many complaints that the Southern Express failed to make its daily record run according to schedule. Tourists insisted that the time-card outsped the train. Then the Southern Express was wrecked and many lives were lost. Traffic officials of the road concluded that the pace was too fast and the scheduled running time was extended an hour. This extension meant the abdication of the throne and the return of the crown to America.

During the period of its humiliation, the Empire State Express made no effort to increase its running time, traffic officials of the New York Central believing that this could not be done with safety. For more than 216 miles of the 440 between New York and Buffalo, the Empire State makes the run at an average speed of more than sixty miles an hour. The highest speed is reached between Fairport and Rochester, where for nine miles the train maintains a speed of 66.33 miles an hour. The train consists of a 144-ton locomotive, of the Central-Atlantic type, one composite, smoking and baggage car, three coaches and one parlor car. The weight of these five cars is 261 tons, and the weight of the entire train, including the engine, is 405 tons.—*From the New York Herald, January 25, 1903.*

ANOTHER SIGNAL SUCCESS FOR THE YANTACAW.

A very successful exhibition of the effectiveness of the "Yantacaw Chemical Fire Extinguisher" has just been given.

A structure, 16 feet high and about 7 feet square, was erected and filled with slats, boards and shavings. It was then thoroughly saturated with kerosene oil and lighted.

The chief of the local fire department took charge of the affair and gave the signal when to play on the fire. He gave the word after allowing the fire to gain a good headway, and the stream was turned on and the fire extinguished in about five seconds.

It was lighted up again and the performance repeated with even greater rapidity than before. The chief then requested permission to try the extinguisher belonging to the Rescue Truck Company on the fire. It was lighted up again and the chief ordered a six-gallon carbonic-acid gas extinguisher turned on, but his efforts to control it were useless and the fire still burned fiercely. The chief then ordered that the Yantacaw play on one side of the box and the carbonic-gas machine on the other. The difference was at once apparent, as the Yantacaw side was instantly black, while the other side still burned. Finally, the Yantacaw went over to the other side and put the fire out. The tests were highly interesting and instructive, as heretofore it has always been conceded that the carbonic gas was the best known extinguisher, but it was proved very plainly at this test that the Yantacaw is away ahead.

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NOTICE TO ARCHITECTS AND BUILDERS.

W. H. Mullins, Salem, Ohio, desires to call the attention of architects and builders to the fact that he has just completed the purchase of the Watson Fireproof Window Company, including all their machinery and dies and the exclusive right to manufacture under the Watson patents in all States and Territories of the United States, also for export, excepting Illinois, Maine, New Hampshire, Vermont, Rhode Island, Massachusetts and the city of Greater New York. Mr. Mullins desires to secure manufacturer's agents in every city throughout their territory, and would be pleased to correspond with parties relative to terms. Catalogues and full information will be cheerfully furnished to all interested parties.

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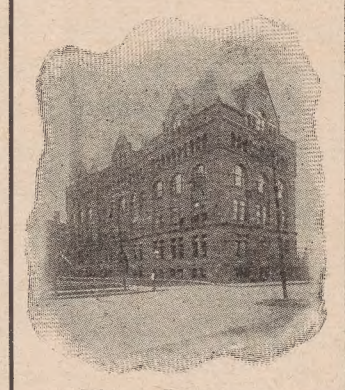

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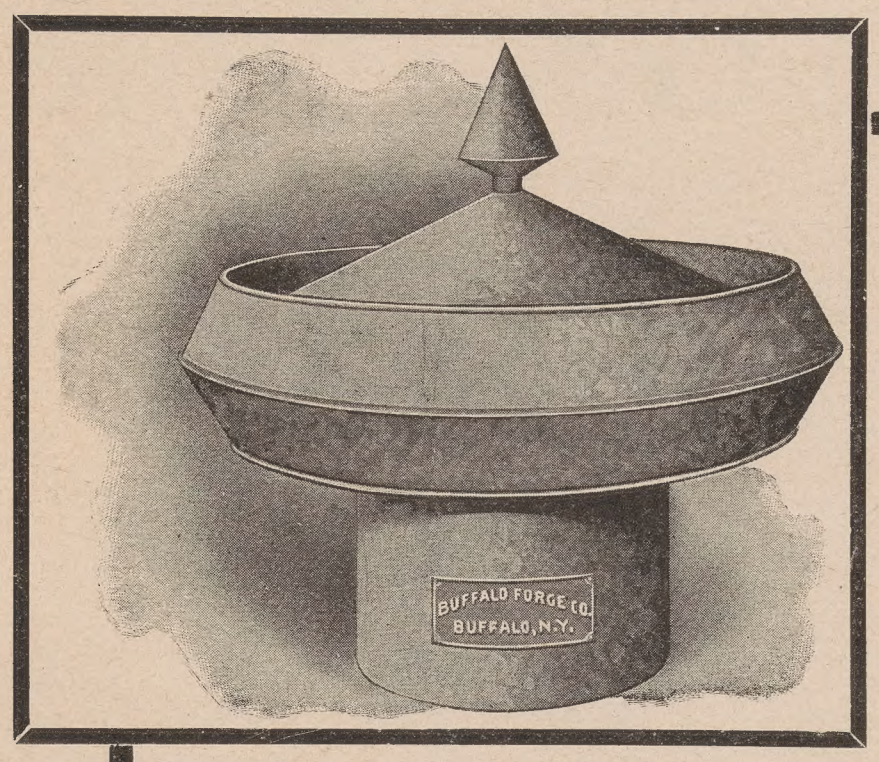

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